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Sundness Report 1956-57 Omega

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A STUDY OF THE ALLUVIAL BLACK SANDS
IN SOUTHERN PINAL COUNTY
FORTY-FIVE MILES NORTH OF
TUCSON, ARIZONA

* * * * * * *

1. Introduction and Objectives

The purpose of this study is to ascertain if these alluvial sands contain values in Iron, Titanium, or other recoverable minerals, which would support an economic operation in the mining and processing of the sands. The principal questions to be answered are the percentages of recoverable magnetite and titanium, their quality, quantity, continuity and uniformity, and to ascertain if gold, Silver, Rare Earths or other minerals are present in economically recoverable quantities.

2. Location of Area

The lands are located on both sides of U. S. Highway 80 running from Tucson to Florence, and approximately 45 miles north of Tucson. An alluvial area about 10 miles wide extends along this highway for many miles, and the lands under consideration are Sections 1, 2, 3, 4 and 5, as well as Section 12 and the North ½ of Section 11, in T-8-S, R-12-E, Gila & Salt River Base and Meridian, as shown on Map on following page. Some drilling and sampling was also done on Sections 10, 9, 8, 15 and 17.

3. Pattern for Drilling and Sampling

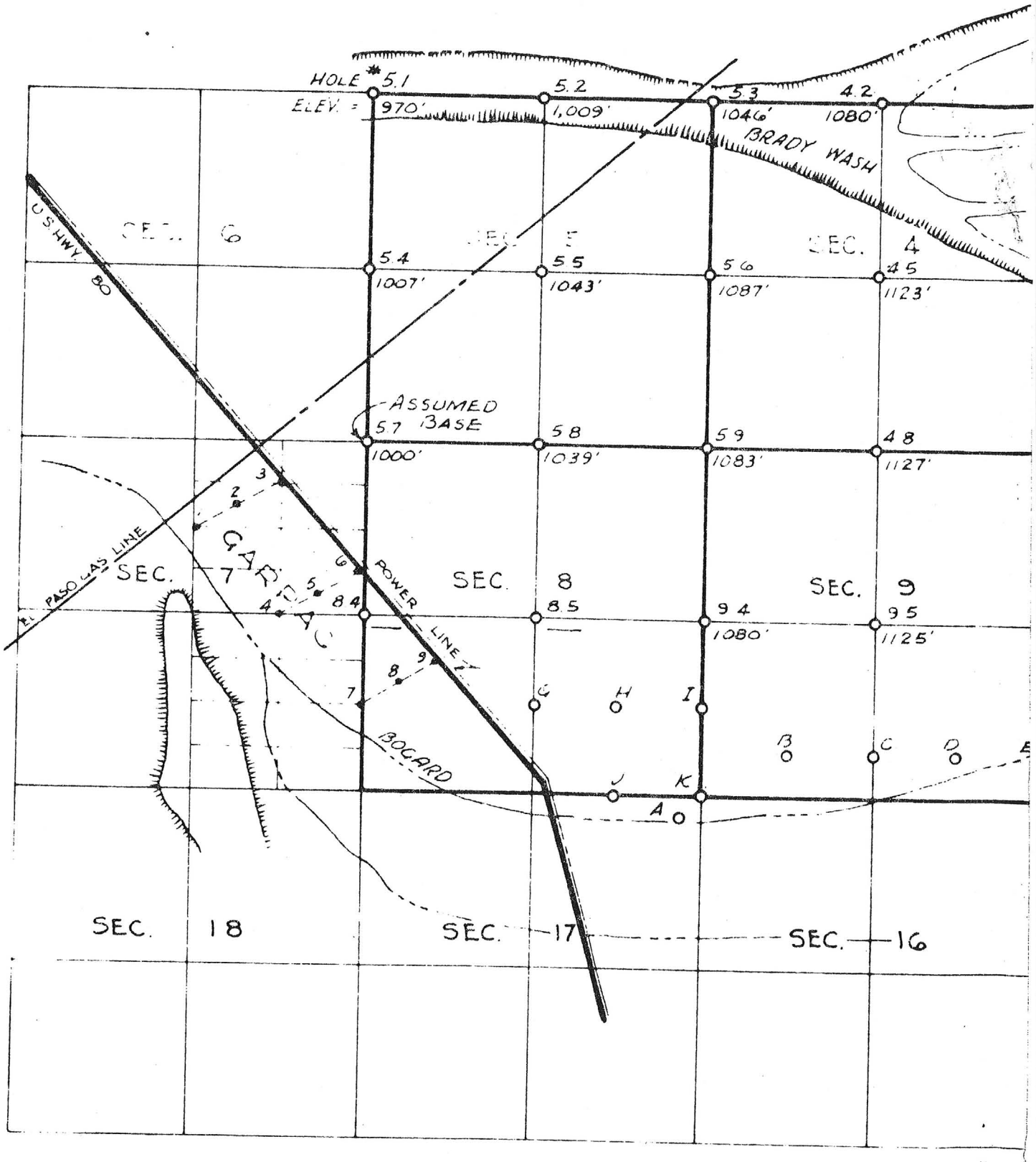
The arbitrary pattern chosen for preliminary drilling and sampling of this area (4160 acres) was to drill 9 holes to a depth of 25 feet on the corners of each quarter section, i.e. three holes on the north Section line, three on the center line, and three on the south Section line as shown on Map. The numbering of these holes was designed to indicate the relative location of the hole as to Section,

SURFACE MAP MUD

IN ALLUVIAL SANDS N

SHOWING LOCATION OF HOLES, COMPARAT

SCALE: 2 1/2" = 1 MILES



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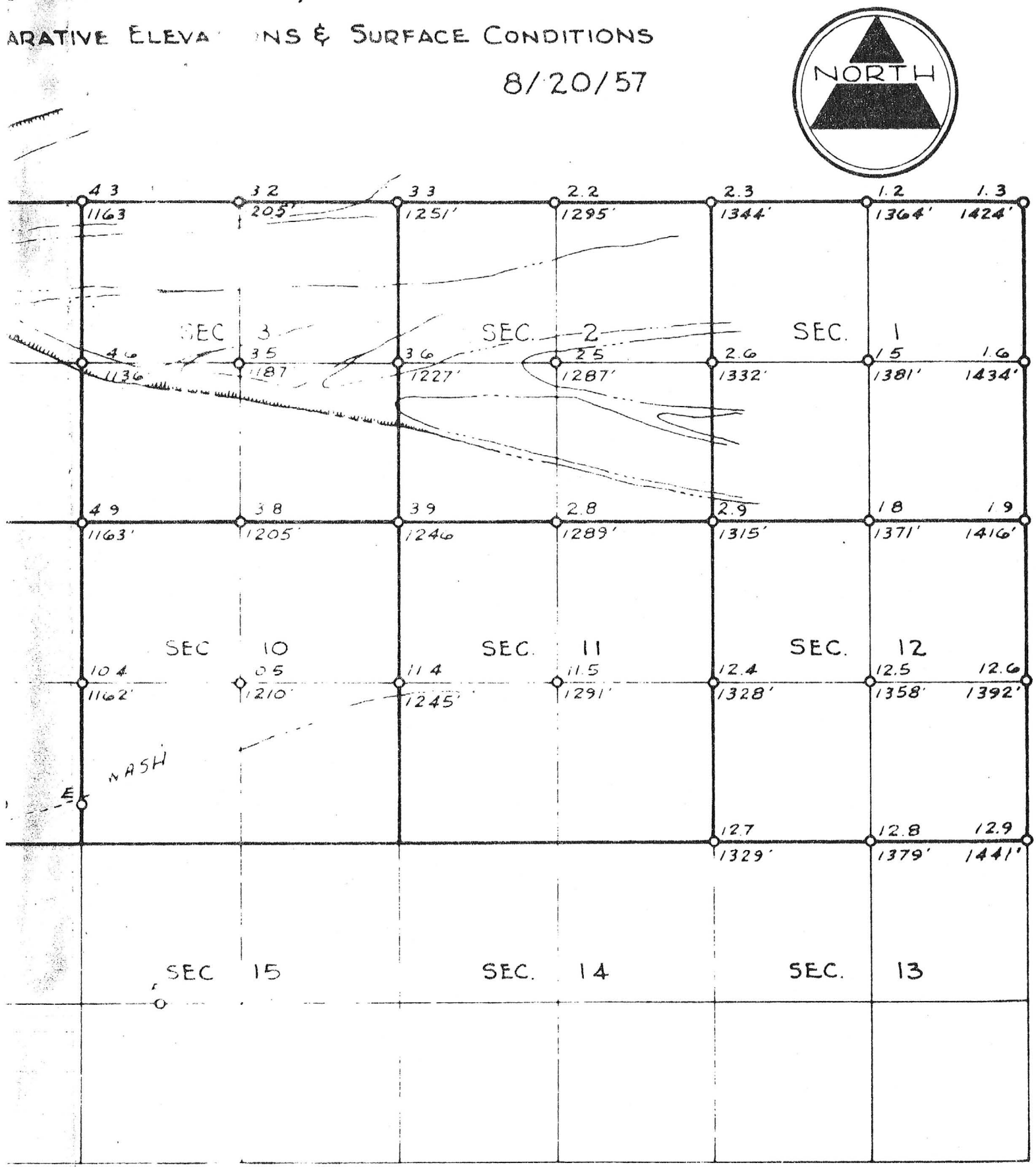

and its position i that Section, hole #1 in h case being in the N.W. corner of the Section. Drilling was started in Sec. 5 hence hole #5.1 is in the northwest corner of Sec. 5, hole 5.2 on the center of the north line, and #5.3 on the N. E. corner of Section 5. Since this point is also the location of what would be #4.1 in the contiguous Sec. 4, its number is dropped, but #4.2 is on the center of the north line of Sec. 4, and #4.3 on the N. E. corner, etc.

The original drilling pattern also included a secondary pattern of holes to be drilled after the analysis of the preliminary pattern had been studied. It consisted of five holes to be drilled for checking purposes on the high-average quarter section and five on the low-average quarter section of each Section if wide variations existed. Because of the relative uniform nature of the preliminary analysis, this program was dispensed with.

4. Drilling Test Holes for Sampling

The sampling of material, such as this, composed of high value, dry, and heavy magnetite, deposited throughout the geological ages in a non-uniform and irregular manner with worthless, slightly moist, and light silt, sand and gravel presents a difficult problem. Honest mistakes, which may lead to erroneous conclusions, must be studiously guarded against.

At the beginning of this program, a light portable, rotary vacuum drill with a 1¼ inch bit was tested out. It was designed to cut a 20 cu. in. sample for each foot of advance. The test was conducted adjacent to a 40 inch hole which had previously been sampled by hand by digging a trench 6 inches wide by 5 inches deep from bottom to top of a 28 foot hole. The comparative results are recorded on the following page. Sample "C", in the hand sampled hole, was a very rich magnetite seam containing 506 Iron Units and very dry. It will be noted that

SAMPLING COMPARISON

HOLE NO. 5

Sampled by hand 5 inch x 6 inch Trench

	US	MAGNETICS JS	TOT	Fe	Fe % Units
	%	%	%	%	
A	6.6	9.1	6.0	39.7	238
B	5.6	7.5	4.2	43.6	183
C	5.5	21.5	11.8	42.9	506
D	5.6	11.6	6.5	38.9	253
E	5.2	13.0	6.8	27.2	185
F	2.9	9.6	2.8	19.3	54
G	3.5	27.6	9.7	32.0	310
Avg.	5.0	13.6	6.8	36.2	246
IRON UNITS			246		

TEST NO. 1

Adjacent to Sample Trench

	US	MAGNETICS JS	TOT	Fe	Fe % Units
	%	%	%	%	
A	17	8.4	6.5	45.5	296
B	7.3	5.2	3.8	40.9	155
C	6.6	13.1	8.6	50.8	437
D	8.0	7.7	6.2	47.6	295
E	6.5	11.3	7.3	45.1	329
F	7.5	10.0	7.5	45.8	344
G	7.6	17.3	13.1	47.0	616
Avg.	7.3	10.4	7.6	46.6	354
IRON UNITS			354		

TEST NO. 2

Opposite the Sample Trench

	US	MAGNETICS JS	TOT	Fe	Fe % Units
	%	%	%	%	
A	7.8	7.0	5.5	44.2	243
B	7.1	7.5	5.3	41.3	219
C	6.7	14.1	9.4	53.9	520
D	8.0	10.5	8.4	44.6	375
E	7.5	10.6	8.0	49.7	398
F	7.2	12.7	9.1	45.6	415
G	7.7	15.9	12.2	45.4	554
Avg.	7.4	11.1	8.3	46.8	388
IRON UNITS			388		

Hole #5 was a 40 inch diameter hole drilled by a custom built earth boring machine to a depth of 28 feet. A 36 inch galvanized culvert with 20 inch slots, 8 feet long, staggered 180 degrees was cut out of culvert for sampling purposes. A sampling scoop, 6 inches wide was penetrated into the virgin ground 5 inches giving a total hand picked sample of 360 cu in per lineal foot – (440 cu in. – .83 cu. ft. - 125 lbs) per 4 foot sample of Sands in Natural condition as to the 8 mesh Undersize and Oversize.

Test #1 and #2 drilled and sampled by Mighty Midget Vacuum drill made by Houston Tool Co., Santa Suzanna, California. Drill designed to produce and catch as a sample in solid ground, 20 cu in per lineal foot of advance. In Loose, dry material, 3 to 4 times as much material is produced.

the drill did fairly well in samples "A" and "B", but, after passing thru sample "C", the dry, high grade, free running magnetite from it trickled down into each subsequent sample, and the low grade sample "F" (54 units), in the hand sampled hole is indicated to be a very acceptable seam, according to the drill results. Because of its portability, its speed in drilling, and ease in handling, several days were spent trying to adapt this drill to the taking of fair samples in this kind of material. However, since it was impossible to devise a method for keeping a casing below the cutting bit, and thus prevent salting, the use of this machine was finally dispensed with.

An earth boring machine capable of drilling holes from 16 inches to 144 inches in diameter was then brought to the property. This machine drilled 40 inch diameter holes to a depth of 28 feet. Into these 40 inch holes a 36 inch diameter, corrugated iron culvert, 28 feet long, having 20 inch slots 8 feet long, staggered at 180 degrees on the opposite sides of the culvert, was lowered into the hole by a hand and power operated winch mounted on a platform truck. This corrugated culvert was designed to furnish ample protection for the sampleman.

5. <u>Sampling the 40 Inch Holes</u>

The sampleman was provided with a heavy aluminum scoop 4 inches wide and an electrically operated chipping hammer in addition to a pick, an adze and small bars to aid in taking a true sample. He was provided with a platform upon which to sit, which was raised and lowered in the hole by means of the hand operated winch. This platform was provided with a small electric fan directly above the samplemans head in order to circulate the air in the excessive heat in these holes. The sampling was done on two shifts per day, light and power being provided by a portable plant mounted on a truck, and everything

possible was done to make the sampleman as comfortable as possible in order to aid in getting a true and fair sample in this difficult material. Because of the hard, cemented nature of so much of this ground, the sampling progress was rather slow, three holes, or seventy-five feet, being the maximum accomplishment on two shifts.

A sample interval of five feet was chosen, and samples were designated A, B, C, D & E from top to bottom of each hole, each letter representing a 5 foot sample, i.e. "5.1A" designates the top 5 foot sample in hole #1 in Section #5. The sampleman started at the bottom of each hole. Since the holes were drilled to a depth of 28 feet, he had ample opportunity to get at a fair sample at the depth 20 to 25 (sample E). The sample was gathered in the 4" aluminum scoop by penetrating it exactly 4 inches into the virgin ground with the aid of chipping hammer, pick, adze and small bars. The volume of the sample so taken was 4"x4"x60" or 960 cu. in. (.555 cu. ft.). The sample scoop was emptied into a bucket attached to a hand-line, and when full, this was hoisted to the surface, dumped into a tub on a platform scale, and, when the 5 foot sample was finished, the tub was carefully weighed and screened on a 6 mesh screen.

For the purpose of this study a 6 mesh screen was chosen for the separating screen below a ¼" scalping screen. The reason for choosing a 6 mesh rather than an 8 or 10 mesh screen was that the test would extend for a distance of 5 miles in a westerly direction, and at its westerly extremity would approach quite close to the foothills where recoverable values might be coarser and would be lost in the oversize waste if a finer separating screen was used. This theory was born out as it will be noted in sieve tests in the appendix that in Sections #1 & #12, the two upper sieves caught 22.5% and 22.9% respectively, while in Section 5 only 16.9% was caught.

The sample was dumped on the double deck screen mounted on legs and setting on two tarpaulins. After screening, the upper tarpaulin containing the 6 mesh undersize, was pulled out and the material was carefully weighed, put in sample sacks and sent to the laboratory. The hinges of the screen were then released and the oversize allowed to slide down on to the second tarpaulin. This material was also carefully weighed, sacked and sent to the laboratory.

6. Diagonal Composite Section

Instead of making complete analysis of each sample in every hole, an arbitrary composite line was chosen for each Section, running diagonally from the NE corner to the SW corner, on which line are holes #3, #5 and #7; or, #9 from adjacent Section. In Sec. 8, 9, 10 & 11, such composite was made on the center line of each Section.

From these arbitrarily chosen Composite holes a sample was taken in the field for moisture content in the Undersize material after it had been weighed. These samples were placed in paraffine coated containers and sent to the laboratory. Computations of weight per cubic foot, or Density in Place, were also made from these three holes on each Section, and Titanium was determined on each sample in hole #5 in order to try to establish its residence, if possible.

7. Moisture Content of 6 Mesh Undersize

Moisture content was determined on the 6 mesh Undersize principally to ascertain if there might be enough moisture present to seriously hamper the dry screening process, especially if fine screening was to be used. In only two individual 5 foot samples was the moisture content found to be slightly over 5%, but generally it was found to be low as indicated by the following tabulation.

Sec. No.	Moisture	Sec. No.	Moisture
1	1.6%	8	2.3%
2	1.5	9	2.0
3	2.0	10	2.5
4	2.1	11	3.0
5	2.1	12	1.3

Average Moisture, 6 Mesh U. S. on 10 Sections, 2.0%

8. Density in Place

From the three holes on each composite section, the weight per cubic foot of the material in place was computed. This figure is required to determine the tonnage available on each Section. From the observations made, it seems that the density does not vary with the Iron content of each 5 foot sample as much as it does with the physical characteristics, such as silt, sand, gravel, and degree of cementation with Caliche. A tabulation showing weight per cu. ft. and the Iron content in the dirty conc. of 6 mesh U. S. is as follows:

Hole No.	Wt/cu.ft.	Iron	Hole No.	Wt/cu.ft.	Iron
5.3	111 lbs.	19.6%	1.3	135	33.5
5.5	123	22.1	1.5	135	27.3
5.7	126	26.3	2.9	117	31.9
4.3	119	20.3	1.9	111	27.5
4.5	119	22.2	12.5	108	35.3
5.9	125	21.9	12.7	115	28.5
3.3	121	17.2	12.4	116	32.8
3.5	114	26.7	11.5	132	23.2
4.9	131	27.3	11.4	127	29.1
2.3	100	20.6	10.5	113	23.4
2.5	120	24.9	10.4	120	22.1
3.9	120	41.3	9.5	124	26.4
			9.4	112	35.6
			8.5	111	24.7

Average of 10 Sections 120 lbs/cu.foot ---26.6 % Iron (Fe.)
Long Ton --------18.66 cu.ft./ton --- 1.45 Tons/cu.yd.
Short Ton -------16.66 " " 1.62 "

9. Physical Characteristics Noted in Sampling

In the 10 square miles sampled (57 holes), no fixed pattern of stratification was noted. Grey, fine silt, and, yellow or red sand and gravel were found unconformably in all holes. Most of the material was tightly cemented by caliche and occasionally one foot to three foot bands of caliche were found. While low in iron content, these

bands were included in the sample because of the impracticability of separating it in a mining operation. Very few boulders, four inches or more in diameter, were encountered in the whole area.

10. Preparation and Processing Samples

Permission was obtained to use the equipment at the School of Mines University of Arizona for the processing of the samples. After processing the bulk samples as they came from the field, a laboratory sample of 2 to 3 ounces was cut from the several fractions of the sample and sent to Lerch Bros. Laboratory at Hibbing, Minnesota, where all chemical determinations were made. All sample splitting was carefully done with a Jones Riffle after samples had been thoroughly mixed for five minutes on the mixing rolls

(a.) Moisture Samples

As soon as the Moisture containers arrived at the University of Arizona, 1000 grams were weighed out of each and placed in the drying oven over night at a temperature of 220 degrees Fahr. These samples were weighed the following morning and the loss of weight indicated the moisture content.

(b.) 6 Mesh Undersize samples

Upon arrival at the University, the Undersize samples were placed in pans in the drying oven at 220 degrees Fahr. until the next morning. They were then taken out and carefully split into a laboratory sample for Lerch Bros., a sample for the Murmanill files, and a 2000 gram sample for magnetic testing. On the individual alphabetical samples in each hole, only an Iron determination was made, except in hole #5 (center hole in each Section) where Titanium was determined in order to attempt to study the residence of this element. No continuity or uniformity was found for either the Iron or the Titanium, as will be noted by a study of the analysis sheets for each Section in

the appendix.

In addition to the individual iron analysis and magnetic test on holes #3, #5 and, #7 or #9, a composite was also made from each of the 5 samples in these holes, upon which composite 7 analysis were made, namely, Iron, Phosphorous, Manganese, Silica, Alumina, Sulphur and Titanium. These analysis will be found at the bottom of each Section analysis sheet in the appendix. From these three composites on the diagonal line shown on the Map, another composite was made up, called the Section Composite and, in theory, was to represent the whole Section, or one square mile. From this Section Composite a 2000 gram sample was cut, after thoro mixing, for a magnetic test, a 3000 gram sample for a Sieve Test, and a 4000 gram sample, which was split in half, for a test on the liberation of Silica and Titanium with an 80 mesh grind and a 150 mesh grind and wet magnetic separation. The results of these tests will also be found at the bottom of the analysis sheet in the appendix. On Sections #1, #3, #5 and #11, a 40 mesh grind was tried, but, as will be noted, the recovery was increased materially at the expense of a very high phosphorous, a higher silica and a very much higher titanium in the finished product, indicating incomplete liberation and elimination of these deleterious elements.

(c) <u>Oversize Samples</u>

No analysis were made of the individual alphabetical oversize samples on the theory that the values would be low in both Iron and Titanium, but samples were cut out for the Murmanill files and are available for further study. A Composite was made of holes #3, #5 and, #7 or #9, and a Section Composite was made from these three Composites, which Composites are still on file at the University. From the Section Composite, a 2000 gram sample was weighed out, after crushing to ¼ inch, and a regular magnetic separation was made. The

results of such separation, which may deserve further economic study, will be found in the appendix under "Comparison Summary of Various Fractions."

(d) Dry Magnetic Separation of 6 Mesh Undersize

The objective in the dry magnetic separation was to produce a "Dirty Concentrate" containing, if possible, all magnetic material in the Undersize. This concentrate would subsequently go to a Ball Mill for grinding to a certain mesh (still to be determined) for the most economical wet magnetic recovery and the liberation and elimination of the deleterious materials. The machine used for this dry separation was a Dings Cross Belt Magnetic Separator. The magnetic field was generated by using 100 Volts and 1¾ Amperes. Periodic testing of the non-magnetic rejects with a hand magnet indicated that a very clean separation was being made.

(e) Sieve Tests

The 3000 grams of 6 mesh Undersize from each Section Composite was processed in a standard Ro-Tap machine, allowing uniformly 5 minutes for each sieve before removing. A magnetic separation was first made on the total sample and each of the two fractions were processed through the sieves separately. The results of these tests will be found in the appendix under "Distribution of Values" for each Section.

Since this study was being made on an unknown material, it will be noted that a top-heavy arrangement of sieves was used, namely, 8, 10, 14 and 20 mesh. This was done in order that the information might be of possible assistance to a person designing a mill for the most economical separation of this material into values and waste. Final economic study may determine that the 8 mesh and the 10 mesh material should be wasted rather than spending further money on its grinding

and magnetic separation.

(f.) Grinding for Liberation of Silica, Phosphorous & Titanium.

While the so-called "Black Sands" are very black when seen in the various stream beds, they are, in point of fact, very dirty when encountered in the virgin ground, being attached to varying size particles of silica, and coated with an Earthy Limonite. In order to produce a high grade product, these elements must be broken off and washed away with water. Some economical break-off point exists for the grinding of this material, but for the purpose of this preliminary study, only a grind to 80 mesh and 150 mesh was used. The results of the 80 mesh grind is recorded on the Section analysis sheets in the Appendix and a comparison of the 80 mesh grind and the 150 mesh grind is recorded on the Distribution of Values Sheet, and, in the "Comparison Summary of Various Fractions". A 40 mesh grind on the Composite of each alternate Section is also recorded here, but the resulting product is very high in Phosphorous and Titanium. These tests are the results of grinding the sample by hand on a bucking-board, with frequent sieving to insure the least possible amount of over-grinding.

11. Gold and Silver Assay - - Spectrographic Analysis.

In order to determine the presence of other values such as Gold, Silver, Rare Earths, or other minerals, sometimes present in these Sands, an assay for Gold and Silver, and a Spectrographic examination of the rejects from the magnetic separation of each Section Composite were made by the Arizona Bureau of Mines at the University of Arizona. The results were all negative and the reports for each Section are inserted in the Appendix following the two pages of statistical data pertaining to each Section.

12. Quality of the Final Product.

From a study of the analysis of the final product on page 41

of the Appendix, it will be seen that a very high grade and desirable product can be produced. The 40 mesh grind leaves considerable Titanium with the Iron, which may be objectionable to many purchasers. The Phosphorous is also high, and may be subjected to a penalty by some buyers.

The 80 mesh grind produces a Phosphorous content similar to a Standard Minnesota, Non-Bessemer ore, presently priced at $11.45 for 51.50 Fe. at Lake Erie ports, but the Titanium at 1.47% is still on the high side. The 150 mesh grind reduces the Titanium to .86%, which should not meet with too much objection, considering the other superior qualities of this product. In this grind the Phosphorous is reduced to an average of .047%, with five out of ten Sections showing a Phos. of .034% to .045%. This Phosphorous content, in the Lake Superior district, would be called a Standard Bessemer ore (below .045% Phos.), and the present Minnesota price is $11.60 per ton for 51.50% Natural Iron delivered at Lake Erie. Ores from Michigan, so called Old Range ores, are priced 25¢ per ton higher than Minnesota ore, and Lump Ore from either district receives a $1.00 per ton premium.

In addition to the chemical analysis made by Lerch Bros., a Composite sample was made up from the high grade concentrate from the 80 mesh grind on Sections 10, 11, and 12, and Holes B, C, D and E. These holes lie approximately along the central east and west axis of a proposed open pit area which will be discussed later. The purpose for making this Composite of the high grade product was to ascertain by Spectrographic analysis, if any deleterious minerals such as Lead, Tin, Copper, Zinc or Arsenic were present, and to determine if any other valuable minerals, such as Chromium, Vanadium, Molybdenum, Nickel or others might exist in recoverable quantities.

The results were negative in all cases and the report of the Arizona Bureau of Mines will be found on the following page

13. Rough Method for Determining Tonnage

With drill holes spaced 1/2 mile apart, and samples taken to only a 25 foot depth in this 10 square mile area, no accurate estimate of recoverable magnetite can be made. However, since some approximate figure must be developed for discussion purposes, the following tabulation is set up for use as a yard stick.

1 Acre contains	43,560	sq ft
to a 25 foot depth	1,089,000	cu.ft of sands
at 120 lbs/cu.foot (page 8)	130,680,000	lbs. " "
2240 lbs/long ton	58,339	Tons " "
(Average Magnetite Recovery (on 10 Sections, 2.9% (page 41 App.)	1,692	Tons Magnetite @ 65% Fe.)
on 40 acres	67,680	" "
on 640 acres (1 sq. mile)	1,082,880	" "
Area sampled, 10 sq. mi.	10,828,800	Tons to 25 ft. depth)

14. Possible Open Pit Area

By reference to Area Map, page 43 in Appendix, it will be noted that a fair degree of uniformity exists as to Undersize, Dirty Concentrate and Concentrate when viewed from the angle of the three-hole Composite Section. However, the Map also shows that there is great variation in the Iron Units for each individual hole. Generally speaking, all of the holes along the North line are low grade. Most of these were drilled from the bottom of Brady Wash, as may be seen by reference to Surface Map on page 2 of text.

Page 42 in the Appendix shows that for whole sampling program on 10 square miles, 288 Iron Units were present in the "Dirty Concentrate" which produced 2.9% of clean concentrate at 65.68% Fe., or, 78 Iron Units must be present in the "Dirty Concentrates" to produce 1 ton of Magnetite with 65% Fe. from an 80 mesh grind. Using this average as a yardstick, a Possible Open Pit area, approx-

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

August 2, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

High Grade Magnetic Concentrate carrying 65 per cent iron -

Composite Sections 10, 11, 12 - Holes B, C, D and E.

Spectrographic Analysis.

Strong	Moderate	Weak	Trace	Nil
Iron	Silicon	Ca	Copper	
		Manganese	Vanadium?	Zinc
	Aluminum		Chromium	Tin
	Magnesium		Lead?	Arsenic
			Molybdenum?	Antimony
			Nickel	

?-Trace questionable

Robert T. O'Haire

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METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

imating 5 square miles, has been outlined on the following page including only the following holes:-

Hole No.	Dirty Concentrate Iron Units	%Recoverable Fe SO_4 @65% Fe. to a depth of 25 ft. within Pit Area
5.6	295	3.8
5.8	458	5.9
5.9	215	2.8
8.3	210	2.7
9.4	338	4.3
GHI Ave.	329	4.2
JAK "	296	3.8
BC "	470	6.0
DE "	392	5.0
F "	352	4.5
10.3	237	3.0
11.4	179	2.3
3.9	722	9.3
11.5	234	3.0
2.8	315	4.2
12.4	344	4.4
2.9	398	5.1
12.5	333	4.3
Average	340	4.38
	340/78 is also	4.36

It must be noted that the south line of Sections 10 and 11 have no drill holes, but B, C, D and E in the south quarter of Section 9 were very good, J, A and K in SE¼ of Section 8, as well as the lone Hole F in Section 15 were also good. Additional information is, however, required to prove the tonnage within the Pit area. The tonnage computation follows:

Long Tons of Sand per acre, 25 ft deep	58,359	Tons Sand
If recovery is 4.4% Magnetite, 65.0% Fe.	2,567	" Fe_3O_4
40 Acres, 25 feet deep	102,680	" "
640 " " " " (1 sq. mile)	1,642,880	" "
5 square miles	8,214,400	" "

15. <u>Conclusions and Recommendations</u>

1. The study has proven that these Alluvial Sands do have a Magnetite-Illmenite content of varying amounts which can be

TABLE OF CONTENTS

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Section 1	Analysis,	Distribution	of Values,	Spectrograph		1, 2, 3
" 2	"	"	"	"	"	4, 5, 6
" 3	"	"	"	"	"	7, 8, 9
" 4	"	"	"	"	"	10,11,12
" 5	"	"	"	"	"	13,14,15
" 8	"	"	"	"		16,17
SE¼ 8	"	"	"	"	"	18,19,20
Section 9	"	"	"	"		21,22
South ½ 9	"	"	"	"	"	23,24,25
Section 10	"	"	"	"	"	26,27,28
" 11	"	"	"	"	"	29,30,31
" 12	"	"	"	"	"	32,33,34
Holes J,A,K	"	"	"	"		35,36
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processed by fine grinding and Wet Magnetic Separation into a very desirable product having no deleterious components. The study has also indicated that no Gold, Silver, Rare Earths, or other valuable minerals are present in the rejects from the dry magnets.

2. The continuity at depth has not been proven. While no apparent reason seems to exist for richer material below the upper 25 feet from the geological deterioration of the adjacent mountains, still, the lowest sample in the present holes was sometimes the highest grade, and, in Hole "A" (Page 35 App.), the Iron Units from 25 feet to 43 feet were nearly double the Units from 0 to 25 feet. If four holes were drilled to a depth of 50 feet, the answer would probably be found. Such holes should be drilled within the Pit area and should best be located, two within 100 feet from the present two lowest grade holes, and two adjacent to the two highest grade holes. Suggested locations might be at 8.5 and 11.4 for testing the low grade areas, and at 3.9 and 12.4 for testing what might lie below in the present high grade holes. The reason for suggesting a new location within 100 feet of a present hole is to study continuity over short distances.

3. No adequate knowledge exists as to water availability. An acceptable product can not be made economically in quantity without grinding, followed by wet magnetic separation. While water is reported available in the Santa Clara Valley, 10 miles away, it would be costly, hence a test for water at or near the property seems imperative.

4. As indicated in the text, the 6 mesh Oversize, crushed to 40 mesh, yields magnetically 2.2% of its own weight, or .9%

of the total weight, at 45.60% Fe. This material, ground to 80 mesh yields .57% of the whole weight with 64.41% Fe, similar to analysis of the concentrates from the Undersize. Since the digging and screening of this material will have been paid for, an economic study seems desirable covering the cost of crushing this kind of material, the cost of grinding to 80 mesh, and the subsequent cost of magnetic recovery.

5. An economic study should also be made of the most desirable separation point in the screening operation. It will be noted from the Screen analysis that only from 100 to 150 Iron Units are caught on the first two sieves in the Magnetic Fraction of the "Dirty Concentrate". These reside in from 15% to 25% of the total 6 mesh Undersize. The elimination of this tonnage from the subsequent high costs of grinding and wet magnetic separation may result in an economic saving and a larger profit.

6. Should a decision be made to proceed with a close economic study of these Milling procedures, the advice of Mr. E. W. Davis, the so-called "Father of Minnesota Taconite" would be very valuable. He is now retired from the University of Minnesota, and is presently retained as a Consultant by Reserve Mining Co., living at Silver Bay, Minnesota. Reserve Mining Co. operates a huge Taconite Beneficiation Plant in Minnesota and is owned jointly by Armco. and Republic Steel Corporation.

Respectfully submitted

O. A. Sundness

O. A. Sundness
Registered Mining Engineer
Minnesota #1003
August 20, 1957

EXPLANATION OF STATISTICAL DATA

On the following pages are recorded the results of the various tests made on the 6 mesh Undersize from the alluvial sands. On the left hand page for each section, the square represents the Section, on which is indicated the position of the mine holes. At the location of each hole, the checkerboard contains the information for each 5 foot sample in this hole. The first column carries the alphabetical designation of each 5 foot sample. The second column shows the percentage of 6 mesh Undersize as weighed and determined in the field. The third column shows the percentage of magnetic recovery from the Undersize, as determined at the University. Column 4 relates this recovery from the Undersize to a recovery from the total sand as dug, by simple multiplication of the two figures. In the fifth column is recorded the metallic iron, as determined by Lerch Bros. Laboratory at Hibbing, Minnesota. A study of this column in each hole indicates that this dry magnetic recovery is, in fact, a very dirty concentrate, requiring finer grinding and water to bring out its high grade values. In the 6th column, "Units", is recorded a figure which is the product from multiplying the figure in column 4 by the figure in column 5, and multiplying the result by 100. It is a convenient term used in comparing samples of varying percentage recovery and varying iron analysis. In practical discussion an Iron Unit is 1% of Iron riding on any vehicle under consideration such as a pound (lb.Unit), or a ton (ton Unit), or a car (car Unit), or a foot (foot Unit), etc. In this case it is the percentage of Iron (Fe.) multiplied by the percentage of recovery, which in turn is multiplied by 100 in order to produce a whole number for convenience in discussion.

In the three holes #3, #5, and #7 or #9 on the NE-SW diagonal line of each Section, an additional column is added showing the

moisture content of each 5 foot sample. Also, in hole #5 (the center hole of each Section), Titanium was determined, and it is recorded on the left hand side of the alphabetical column.

Secondary drilling was originally contemplated on the high Iron unit average, and the low Iron unit average of each quarter section. Such quarter section values are shown on each quarter section of the Map, but, because of apparent uniformity, this secondary drilling was dispensed with.

Below the Section Map is recorded the results of the Composite samples made from holes #3, #5 and #7 or #9 and the magnetic recovery from the Undersize, and such recovery related to the Total Material is shown, and, seven chemical determinations are shown for each Composite. These results from each Composite are arithmetically combined and shown as "Avg. Sec.-" in the tabulation. In the lower right hand corner the results from an 80 mesh grind are recorded, showing the recovery percentage from the Dirty Concentrates, and 9 chemical analysis of the finished high grade concentrate. By multiplying this recovery by the percentage recovery of Dirty Concentrate from total, as shown under "Avg. Sec.", the total percentage of recoverable high grade magnetite for the Section is obtained. i.e. for Section #1, 38% clean concentrate recovered from 9.2% "Dirty Concentrate" is 3.50% recovery by weight of a clean concentrate carrying 65.54% Fe. for this whole Section.

On the right hand page for each Section are tabulated a distribution of values for each fraction of the sample, Iron Units lost and recovered, Sieve Test results on the magnetic and non-magnetic fraction of the Dirty Concentrate as well as a mathematical combination of these, to indicate the physical and chemical characteristics of the original sample. At the bottom of the page is a comparison of

the recovery and analysis of the 80 mesh grind, the 150 mesh grind. The 40 mesh grind is also listed on the alternate Sections where this test was made, and it will be noted that the Phosphorous and the Titanium are both very high.

Referring to Section #1, it is indicated that 588 Iron Units are available in the sample. One hundred fifty-six of these Units reside in the Oversize, and for this study, are considered as waste material. However, 73 Units, or 17.1% by weight of the Oversize and 12.4% of the total Iron Units are magnetically recoverable by crushing to ¼ inch if the economics permit such recovery. Time did not permit a comprehensive study of this Oversize, but a Composite was made up of this material, which had been crushed to ¼". This was further crushed to 40 mesh, magnetically separated, and the magnetic recovery ground to 80 mesh and treated by wet magnetic separating. The results of this test will be found in "Comparison Summary of Various Fractions" page No. 39. Further study should be given to possible additional recovery from this fraction.

Also, it will be noted that 432 Iron Units reside in the 6 mesh Undersize, from which only 277 Units, 16.2% by weight of the Undersize and only 47.1% of the total Iron Units are recovered as a "Dirty Concentrate." This low recovery, or apparent big loss of Iron Units, in this Undersize fraction, indicated the need for a Petrographic study to determine, if recoverable Hematite was present, and the nature and composition of this Iron. A sample of the rejects from the magnetic separation was sent to Dr. G. M. Schwartz, State Geologist, at the University of Minnesota, in the absence of the Petrographer at the University of Arizona. Mr. Schwartz's report is quoted as follows:

"Magnetic rejects Nos. 1 and 2 combined.

The sample consists of fine to coarse yellow sand and finely crushed material.

An examination with a binocular shows that the yellow color is a result of earthy limonite on the grains. This was checked by treatment with hydrochloric acid and tin which dissolved the limonite. The solution when neutralized by ammonia gave a brown precipitate thus verifying the solution of the limonite. This in turn shows that part of the iron is present as earthy limonite which is not recoverable except by solution. The acid also shows that there is considerable calcium carbonate, as one would expect in an environment where caliche is abundant. After treatment with acid the sample has a light gray color and it is possible to study the minerals better than before treatment.

The sample consists mainly of quartz, feldspar, mica (both muscovite and biotite).

The principal iron-bearing mineral other than the dissolved limonite is biotite but this contains only a small amount of iron.

There are a very few opaque grains, some are slightly magnetic probably ilmenite plus a little magnetite, others are non-magnetic, probably ilmenite.

Petrographic Microscopic Examination.

To verify the transparent minerals some of the sand which had been treated with HCl was crushed and examined in index oils. As indicated by the binocular examination the principal minerals are quartz and feldspar. The feldspars include both microcline and plagioclase. This indicates that the principal source of the sand was a granite. Minor amounts of accessory minerals such as titanite and zircon were noted.

This examination indicates that most of the iron is present as earthy limonite coatings plus some in biotite and that in either case this is not recoverable.

NOTE: This is not the usual type of so-called "black sand". The usual type is derived from basic igneous rocks, whereas this was evidently derived from a granite.

(Signed) G. M. Schwartz
July 23, 1957 "

Apparently the escaping Iron Units in the Undersize Fraction do not reside in a recoverable Hematite and must be considered as an unrecoverable loss.

As the third statistical page for each Section, the report of the Arizona Bureau of Mines, showing a Gold and Silver assay, and a

[illegible]ographic analysis on the rejects from the magnetic separation of each Section composite has been inserted.

At the end of this Appendix will be found four pages containing a Summary of the various items developed separately on the previous pages.

SECTION 1.T-8-S R-12-E.

MURMANILL EXPLORATI N

1

#2.3 EL. = 1344

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %
A	62	9.7	6.0	29.5	177
B	51	9.8	5.0	18.3	92
C	61	17.3	10.6	18.6	197
D	54	17.8	9.6	21.1	203
E	47	14.0	6.6	16.9	112
Avg	55	13.7	7.6	20.6	156

Fe Units NW 1/4 219

#1.2 EL. = 1364

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %
A	63	11.9	7.5	37.2	279
B	42	19.1	8.0	25.3	202
C	48	18.4	8.8	23.0	202
D	52	14.2	7.9	35.6	281
E	48	13.1	6.3	26.2	165
Avg	51	15.0	7.7	29.4	226

Fe Units NE 1/4 230

#1.3 EL. = 1424

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %	US H_2O %
A	62	13.9	8.6	28.5	245	2.0
B	56	16.9	9.5	30.1	286	1.2
C	58	11.9	6.9	30.1	208	1.1
D	56	16.3	9.1	39.7	361	1.7
E	49	14.5	7.1	39.5	280	1.8
Avg	56	14.7	8.2	33.5	276	1.6

#2.6 EL. = 1332

MAGNETICS

	US	US	TOT	Fe	UNITS
A	57	12.1	6.9	26.4	182
B	56	17.1	9.6	22.2	213
C	46	20.8	9.6	32.9	316
D	61	20.6	12.6	36.7	462
E	55	12.8	7.0	31.5	220
Avg	55	16.6	9.1	30.5	279

Fe Units SW 1/4 286

#1.5 EL. = 1381

MAGNETICS

	TiO_2	US	US	TOT	Fe	UNITS	US H_2O
A	1.34	41	19.4	8.0	14.3	114	2.4
B	2.58	50	16.6	8.3	25.4	211	1.3
C	3.11	51	15.0	7.6	34.2	260	1.6
D	4.00	43	16.5	7.1	32.9	234	1.6
E	3.55	50	16.9	8.4	30.5	256	1.2
Avg	2.94	47	16.8	7.9	27.3	215	1.6

Fe Units SE 1/4 190

#1.6 EL. = 1434

MAGNETICS

	US	US	TOT	Fe	UNITS
A	48	7.3	3.5	14.9	52
B	51	8.7	4.4	29.5	130
C	67	16.6	11.1	37.6	417
D	48	17.1	8.2	23.5	193
E	51	16.3	8.3	26.3	218
Avg	53	13.4	7.1	28.5	202

#2.9 EL. = 1315

MAGNETICS

	US	US	TOT	Fe	UNITS	US H_2O
A	57	24.0	13.7	29.8	408	2.1
B	69	36.6	11.5	30.0	345	2.1
C	76	26.4	20.1	35.5	714	1.1
D	58	19.7	11.4	33.1	377	1.7
E	54	10.8	5.8	25.3	147	1.7
Avg	63	19.9	12.5	31.9	398	1.7

#1.8 EL. = 1371

MAGNETICS

	US	US	TOT	Fe	UNITS
A	65	16.2	8.9	24.1	214
B	48	12.2	5.9	22.2	131
C	64	9.2	5.9	22.1	130
D	68	12.3	8.4	32.9	276
E	58	8.9	5.2	21.2	110
Avg	59	11.7	6.9	25.1	172

#1.9 EL. = 1416

MAGNETICS

	US	US	TOT	Fe	UNITS
A	61	11.3	6.9	21.3	147
B	54	12.8	6.9	27.5	190
C	64	11.5	7.4	36.6	271
D	60	7.1	4.3	29.2	126
E	50	10.7	5.3	21.7	115
Avg	58	10.6	6.2	27.5	170

DIRTY CONCENTRATES

DIRTY MAGNETIC CONCENTRATES

	Composite 1.3			Composite 1.5			Composite 2.9			Avg Sec. 1			80 Mesh Grind			
	Dirty Conc.	Mag Rej.	US Tot	Dirty Conc.	Mag Rej.	US Tot	Dirty Conc.	Mag Rej.	US Tot	Dirty Conc.	Mag Rej.	US Tot	Clean Conc.	Tails	Slime	Total D.C.
% Rec. US	14.2	85.8	100.0	16.5	83.5	100.0	19.0	81.0	100.0	16.6	83.4	100.0	—	—	—	—
on Total	8.0	48.0	56.0	7.8	39.2	47.0	12.0	51.0	63.0	9.2	46.1	55.3	38.0	40.1	21.9	100.0
Fe	33.27	3.38	7.62	28.13	2.89	7.05	27.49	2.65	7.37	29.63	2.97	7.35	65.54	10.55	7.83	100.0
Pb	.390	—	—	.219	—	—	.300	—	—	.303	—	—	.084	—	—	—
Mn	.38	—	—	.28	—	—	.25	—	—	.33	—	—	.18	—	—	—
SiO_2	28.95	—	—	30.00	—	—	31.40	—	—	30.12	—	—	3.65	—	—	—
Al_2O_3	7.10	—	—	7.92	—	—	7.30	—	—	7.44	—	—	1.18	—	—	—
Sul	.008	—	—	.008	—	—	.007	—	—	.008	—	—	.006	—	—	—
TiO_2	3.46	.66	1.06	2.68	1.02	1.29	3.40	.60	1.13	3.18	.76	1.16	1.70	7.20	2.20	4.01
CaO													.97	—	—	—
MgO													.37	—	—	—

CONVERSION FACTOR

SEC. 1
- Fe Units 234
- lbs/cu.ft. 129
- Mag Rec 3.50 %

Moisture 1.60%
Caliche 0
Boulders 0

O. A. SUNDNESS

SECTION #1

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	44.7	3.50	- -	156			26.5
U.S.	55.3	7.81	1.54	432			73.5
Total Sands	100.0	5.88	- -	588			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of Whole				
.S.Total	100.0	3.50	- -	44.7	156			
agnetic	17.1	9.59	- -	7.6		73		12.4
Non-Mag	82.9	2.24	- -	37.1		83		14.1
ry Mag.Heads	100.0	7.81	1.54	55.3	432			
Non-Mag.Rej.	83.8	3.36	1.06	46.3		155		26.4
.C.Rec'y.	16.2	30.85	4.01	9.0			277	47.1
Mill Heads	100.0	30.85	4.01	9.0	277			
Tails	40.1	10.55	7.20	3.6		38		6.5
Slime	21.9	7.83	2.20	2.0		16		2.7
80 Mesh Conc.	38.0	65.54	1.70	3.4			223	37.9

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO2	Non-Mag. Reject %	Non-Mag. Reject Fe	Non-Mag. Reject TiO2	Total 6 Mesh U.S. %	Total 6 Mesh U.S. Fe	Total 6 Mesh U.S. TiO2
On 8	8.1	6.23	1.30	8.0	1.76	.41	8.0	2.49	.55
10	15.9	8.46	1.81	14.2	1.92	.71	14.5	3.08	.91
14	14.5	14.21	3.23	13.4	2.16	.70	13.6	4.23	1.13
20	12.0	23.47	4.70	11.5	2.48	.55	11.6	5.99	1.24
40	27.8	43.74	5.84	19.5	3.92	1.36	20.8	12.55	2.33
80	18.2	54.12	3.76	16.2	4.80	2.34	16.5	13.57	2.61
100	1.7	54.60	2.31	3.6	4.72	1.32	3.3	8.79	1.40
200	1.2	48.85	2.14	8.3	4.00	1.07	7.2	5.25	1.10
-200	.6	25.38	1.97	5.3	3.52	.65	4.5	4.00	.68
Total	100.0	30.40	3.81	100.0	3.22	1.11	100.0	7.61	1.54

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	38.0%	65.54	.084	.18	3.65	1.18	.006	1.70	.97	.37
150 "	37.5%	66.98	.072	.22	2.75	1.00	.010	1.05	1.02	.42
40 "	49.7%	58.63	.243	- -	5.88	1.65	- -	4.40	- -	- -

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 1, T8S, R12E assayed as follows:

Gold - nil
Silver - less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Strontium	Gallium
Aluminum	Iron	Potassium	Molybdenum
Silicon	Titanium	Chromium	Nickel
Magnesium	Sodium		Copper
			Barium
			Lead

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION 2, T-8-S R-12-E.

MURMANILL EXPLORATION

\# 3.3 EL. = 1251

		US	MAGNETICS US	TOT	Fe	UNITS
		%	%	%	%	%
5	A	61	12.4	7.6	11.7	89
10	B	51	18.0	9.2	15.3	141
15	C	46	15.7	7.2	17.2	124
20	D	52	13.5	7.0	20.6	144
25	E	58	16.4	9.5	20.8	198
	Avg	54	15.1	8.1	17.2	139

Fe Units NW 1/4 148

\# 2.2 EL. = 1295

		US	MAGNETICS US	TOT	Fe	UNITS
		%	%	%	%	%
	A	58	6.0	3.5	16.8	59
	B	63	16.0	10.1	18.8	190
	C	69	11.0	7.6	19.0	144
	D	52	6.4	3.3	14.3	47
	E	53	7.9	4.2	18.2	76
	Avg	59	9.7	5.7	18.0	103

Fe Units NE 1/4 178

\# 2.3 EL. = 1344

		US	MAGNETICS US	TOT	Fe	UNITS	US H_2O
		%	%	%	%	%	%
	A	62	9.7	6.0	29.5	177	.02
	B	51	9.8	5.0	18.3	92	2.0
	C	61	17.3	10.6	18.6	197	2.6
	D	54	17.8	9.6	21.1	203	2.9
	E	47	14.0	6.6	16.9	112	2.0
	Avg	55	13.7	7.6	20.6	156	1.9

\# 3.6 EL. = 1227

		US	MAGNETICS US	TOT	Fe	UNITS
5	A	75	10.9	8.2	34.3	281
10	B	68	13.5	9.2	27.9	257
15	C	56	10.7	6.0	16.0	96
20	D	45	12.5	5.6	21.9	122
25	E	58	13.9	8.1	16.4	133
	Avg	60	12.3	7.4	24.0	178

Fe Units SW 1/4 347

\# 2.5 EL. = 1287

	TiO_2		US	MAGNETICS US	TOT	Fe	UNITS	US H_2O
	2.14	A	62	13.2	8.2	21.2	174	1.2
	2.50	B	61	18.4	11.2	29.4	329	1.4
	2.54	C	66	8.8	5.8	26.4	153	0.8
	2.18	D	46	11.1	5.1	16.9	86	1.0
	2.07	E	74	6.2	4.6	27.8	128	0.7
	2.29	Avg	62	11.2	7.0	24.9	174	1.0

Fe Units SE 1/4 291

\# 2.6 EL. = 1332

		US	MAGNETICS US	TOT	Fe	UNITS
	A	57	12.1	6.9	26.4	182
	B	56	17.1	9.6	22.2	213
	C	46	20.8	9.6	32.9	316
	D	61	20.6	12.6	36.7	462
	E	55	12.8	7.0	31.5	220
	Avg	55	16.6	9.1	30.5	279

\# 3.9 EL. = 1246

		US	MAGNETICS US	TOT	Fe	UNITS	US H_2O
5	A	75	19.3	14.5	35.9	521	0.6
10	B	66	30.5	20.1	47.3	931	1.2
15	C	61	35.2	21.5	52.3	1124	0.8
20	D	71	29.2	20.7	39.3	814	1.4
25	E	49	21.6	10.6	18.8	199	4.2
	Avg	64	27.1	17.5	41.3	722	1.5

\# 2.8 EL. = 1289

		US	MAGNETICS US	TOT	Fe	UNITS
	A	69	22.4	15.5	30.1	466
	B	65	20.5	13.3	33.9	451
	C	57	9.5	5.4	19.1	103
	D	71	9.3	6.6	27.0	178
	E	67	14.2	9.5	39.7	377
	Avg	66	15.3	10.1	31.3	315

\# 2.9 EL. = 1315

		US	MAGNETICS US	TOT	Fe	UNITS
	A	57	24.0	13.7	29.8	408
	B	69	16.6	11.5	30.0	345
	C	76	26.4	20.1	35.5	714
	D	58	19.7	11.4	33.1	377
	E	54	10.8	5.8	25.3	147
	Avg	63	19.9	12.5	31.9	398

DIRTY CONCENTRATES

DIRTY MAGNETIC CONCENTRATES

	Composite 2.3			Composite 2.5			Composite 3.9			Avg Sec 2			80 Mesh Grind			
	Dirty Conc	Mag Rej	US Tot	Dirty Conc	Mag Rej	US Tot	Dirty Conc	Mag Rej	US Tot	Dirty Conc	Mag Rej	US Tot	Clean Conc	Tails	Slime	Total D.C.
% Rec. US	14.3	85.7	100.0	11.5	88.5	100.0	24.0	76.0	100.0	16.6	83.4	100.0	—	—	—	—
on Total	7.9	47.1	55.0	7.1	54.9	62.0	15.4	48.6	64.0	10.1	50.2	60.3	38.3	41.0	20.7	100.0
Fe	18.09	2.40	4.64	26.20	2.33	5.07	35.54	3.52	11.20	26.61	2.75	6.97	66.79	8.52	7.31	30.59
Pb	.198	—	—	.231	—	—	.270	—	—	.233	—	—	.072	—	—	—
Mn	.32	—	—	.30	—	—	.32	—	—	.31	—	—	.32	—	—	—
SiO_2	43.85	—	—	39.55	—	—	32.39	—	—	38.60	—	—	2.45	—	—	—
Al_2O_3	9.20	—	—	6.51	—	—	6.00	—	—	7.24	—	—	1.65	—	—	—
Sul	.007	—	—	.007	—	—	.004	—	—	.006	—	—	.006	—	—	—
TiO_2	2.10	.90	1.07	4.10	.64	1.04	3.90	1.84	2.33	3.36	1.13	1.48	1.15	4.37	1.81	2.61
CaO													1.10	—	—	—
MgO													.32	—	—	—

CONVERSION FACTOR

SEC. 2
Fe Units 274
lbs/cu ft. 113
Mag. Rec. 3.87%

Moisture 1.5%
Caliche 0
Boulders 0

SECTION #2

Distribution of Values

	Percentage Weight	Fe	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	39.7	2.85	- -	113			20.5
U.S.	60.3	7.26	1.09	438			79.5
Total Sands	100.0	5.51	- -	551			100.0

	Percentage Fraction	Fe	TiO2	Weight % of Whole				
O.S.Total	100.0	2.85	- -	39.7	113			
Magnetic	11.0	10.93	- -	4.4		48		8.7
Non-Mag	89.0	1.85	- -	35.3		65		11.8
Dry Mag.Heads	100.0	7.26	1.09	60.3	438			
Non-Mag.Rej.	84.7	3.05	.82	51.1		156		28.3
D.C.Rec'y	15.3	30.59	2.61	9.2			282	51.2
Mill Heads	100.0	30.59	2.61	9.2	282			
Tails	41.0	8.52	4.37	3.8		32		5.8
Slime	20.7	7.31	1.81	1.9		15		2.7
80 Mesh Conc.	38.3	66.79	1.15	3.5			235	42.7

Sieve Test on Composit of 6 Mesh U. S.

	Dirty Conc.Rec'y %	Fe	TiO2	Non-Mag. Reject. %	Fe	TiO2	Total 6 Mesh U.S. %	Fe.	TiO2.
On 8	7.5	5.14	.92	7.1	1.61	1.85	7.1	2.19	1.70
10	17.2	7.23	.66	14.3	1.61	1.04	14.8	2.63	.97
14	15.0	11.65	2.36	13.6	1.61	.89	13.8	3.32	1.14
20	12.0	23.79	4.44	11.7	1.77	.60	11.7	5.29	1.21
40	27.0	45.09	5.03	18.9	2.97	1.41	20.3	11.79	2.17
80	17.4	54.01	2.42	16.0	3.86	2.38	16.2	12.25	2.39
100	1.7	53.45	2.04	3.4	4.02	1.33	3.1	8.27	1.39
200	1.3	47.74	1.73	9.6	3.70	.99	8.3	4.76	1.01
-200	.9	23.63	1.54	5.4	3.83	3.29	4.7	3.95	3.24
Total	100.0	29.54	2.92	100.0	2.62	1.44	100.0	6.83	1.67

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	38.3%	66.79	.072	.32	2.45	1.65	.006	1.15	.32	1.10
150 "	37.3%	68.24	.034	.16	1.75	1.00	.006	.80	.30	.87

No Test made.

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 2, T8S, R12E assayed as follows:

Gold - Trace
Silver - Less than 0.05 oz. per ton

Spectrographic analysis:

Strong	Medium	Weak	Trace
Calcium	Chromium	Strontium	Lead
Aluminum	Manganese	Potassium	Barium
Silicon	Iron		Nickel
Magnesium	Titanium		Zinc
	Sodium		Silver ?
			Copper
			Molybdenum

George H. Roseveare
George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION 3, T-8-S, R-12-E.

MURMANILL EXPLORATION

\# 4.3 EL. = 1163

		US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
5	A	53	14.6	7.7	15.6	120
10	B	58	17.5	10.1	19.3	195
15	C	55	20.2	11.1	29.1	323
20	D	52	15.6	8.1	18.2	147
25	E	60	15.2	9.1	16.4	149
	Avg	56	16.6	9.2	20.3	187

Fe Units NW 1/4 199

\# 3.2 EL. = 1205

	US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
A	57	9.6	5.5	27.3	150
B	61	6.5	4.0	20.9	80
C	57	5.5	3.1	25.9	80
D	60	8.0	4.8	37.5	180
E	71	6.4	4.5	36.6	165
Avg	61	7.2	4.4	30.1	131

Fe Units NE 1/4 170

\# 3.3 EL. = 1251

	US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %	US H_2O %
A	61	12.4	7.6	11.7	89	2.1
B	51	18.0	9.2	15.3	141	1.7
C	46	15.7	7.2	17.2	124	1.1
D	52	13.5	7.0	20.6	144	0.9
E	58	16.4	9.5	20.8	198	0.7
Avg	54	15.1	8.1	17.2	139	1.3

\# 4.6 EL. = 1136

		US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
5	A	79	11.2	8.8	32.2	283
10	B	75	8.9	6.7	31.4	210
15	C	73	8.9	6.5	38.1	248
20	D	74	9.0	6.7	36.2	243
25	E	75	8.8	6.6	33.8	223
	Avg	75	9.4	7.1	34.2	242

Fe Units SW 1/4 240

\# 3.5 EL. = 1187

	TiO_2	US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %	US H_2O %
A	3.64	76	16.0	12.2	43.1	525	1.2
B	1.40	61	20.2	12.3	17.1	210	2.2
C	1.43	54	10.0	5.4	12.4	67	2.7
D	2.00	66	6.6	4.4	23.4	103	2.4
E	2.26	72	13.2	9.5	27.7	263	2.0
Avg	2.23	66	13.3	8.8	26.7	234	2.1

Fe Units SE 1/4 347

\# 3.6 EL. = 1227

		US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
	A	75	10.9	8.2	34.3	281
	B	68	13.5	9.2	27.9	257
	C	56	10.7	6.0	16.0	96
	D	45	12.5	5.6	21.9	122
	E	58	13.9	8.1	16.4	133
	Avg	60	12.2	7.4	24.0	178

\# 4.9 EL. = 1163

		US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %	US H_2O %
5	A	65	17.8	11.6	32.9	382	1.6
10	B	66	25.7	17.0	35.2	598	4.0
15	C	47	9.4	4.4	13.8	61	2.7
20	D	63	4.2	2.6	12.5	32	2.3
25	E	49	14.0	6.9	12.5	86	2.3
	Avg	58	14.6	8.5	27.3	232	2.6

\# 3.8 EL. = 1205

	US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
A	66	13.0	8.6	27.9	240
B	63	17.5	11.0	22.7	250
C	61	15.0	9.1	24.0	218
D	62	18.4	11.4	29.5	336
E	48	25.7	12.3	18.3	225
Avg	60	17.5	10.5	24.2	254

\# 3.9 EL. = 1246

	US %	Magnetics US %	Magnetics TOT %	Magnetics Fe %	Magnetics UNITS %
A	75	19.3	14.5	35.9	521
B	66	30.5	20.1	47.3	951
C	61	35.2	21.5	52.3	1124
D	71	29.2	20.7	39.3	814
E	49	21.6	10.6	18.8	199
Avg	64	27.1	17.5	41.3	722

DIRTY CONCENTRATES

DIRTY MAGNETICS CONCENTRATES — CONVERSION FACTOR

	Composite 3.3			Composite 3.5			Composite 4.9			Avg. Sec. 3			80 Mesh Grind			
	Dirty Conc.	Mag Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot	Clean Conc.	Tails	Slime	Total D.C.
% Rec. U.S.	15.3	84.7	100.0	13.1	86.9	100.0	13.4	86.6	100.0	13.9	86.1	100.0	—	—	—	—
on Total	8.3	45.7	54.0	8.6	57.4	66.0	7.8	50.2	58.0	8.2	51.1	59.3	31.4	43.6	25.0	100.0
Fe	19.00	2.71	5.20	23.31	3.36	5.83	25.82	3.76	6.72	22.71	3.28	5.98	64.74	5.83	5.75	24.81
Pb	.225	—	—	.204	—	—	.395	—	—	.275	—	—	.076	—	—	—
Mn	.26	—	—	.28	—	—	.26	—	—	.27	—	—	.24	—	—	—
SiO_2	47.95	—	—	38.95	—	—	46.56	—	—	44.48	—	—	3.76	—	—	—
Al_2O_3	11.50	—	—	8.54	—	—	7.00	—	—	9.00	—	—	1.27	—	—	—
Sul	.007	—	—	.004	—	—	.005	—	—	.005	—	—	.006	—	—	—
TiO_2	1.83	.37	.59	2.23	.73	.93	3.12	1.40	1.63	2.39	.83	1.05	1.77	3.07	.91	2.12
CaO													1.56			—
MgO													.57			—

SEC 3 — Fe Units 258 — lbs/cuft 122

Moisture 2.0 %

Caliche 0 %

SECTION #3

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	40.7	3.00	- -	122			26.8
U.S.	59.3	5.61	.94	333			73.2
Total Sands	100.0	4.55	- -	455			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of Whole			
O.S.Total	100.0	3.00	- -	40.7	122		
Magnetic	16.0	9.12	- -	6.5		59	13.0
Non-Mag	84.0	1.84	- -	34.2		63	13.8
Dry Mag.Heads	100.0	5.61	.94	59.3	333		
Non-Mag.Rej.	86.6	2.72	.82	51.4		140	30.8
D.C.Rec'y	13.4	24.31	1.72	7.9		193	42.4
Mill Heads	100.0	24.31	1.72	7.9	193		
Tails	43.6	5.83	.91	3.4		20	4.4
Slime	25.0	5.75	3.07	2.0		11	2.4
80 Mesh Conc.	31.4	64.74	1.77	2.5		162	35.6

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO2	Non-Mag.Reject. %	Non-Mag.Reject. Fe	Non-Mag.Reject. TiO2	Total 6 Mesh U. S. %	Total 6 Mesh U. S. Fe	Total 6 Mesh U. S. TiO2
On 8	9.8	5.27	1.00	7.9	1.84	.64	8.1	2.38	.70
10	20.3	7.26	1.02	12.9	1.92	.51	13.9	2.94	.61
14	15.7	11.18	1.70	12.7	2.00	.40	13.1	3.44	.60
20	11.8	19.40	4.20	10.8	2.16	.37	11.0	4.59	.91
40	22.7	40.71	4.46	17.4	3.59	.60	18.1	8.63	1.23
80	15.4	53.08	2.82	15.3	4.15	1.86	15.3	10.57	1.99
100	1.5	52.04	1.50	3.4	3.83	1.17	3.2	6.90	1.19
200	1.3	44.62	1.46	10.0	3.99	.93	8.8	4.76	.94
-200	1.5	15.57	1.32	9.6	3.83	.37	8.5	4.11	.39
Total	100.0	25.4	2.57	100.0	3.04	.76	100.0	5.91	1.00

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe	Pb.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	31.4%	64.74	.076	.24	3.76	1.27	.006	1.77	1.56	.57
150 "	30.5%	66.09	.057	.22	3.56	1.40	.008	.76	1.36	.48
40 "	34.8%	60.51	.231	- -	5.84	2.50	- -	3.26	- -	- -

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 3, T8S, R12E assayed as follows:

Gold - Trace
Silver - Less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Chromium	Strontium	Lead
Aluminum	Manganese	Potassium	Nickel
Silicon	Iron	Sodium	Silver
Magnesium	Titanium		Zinc
			Copper
			Molybdenum
			Zirconium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION 4. T-8-N. R-12-E.

MURMANILL EXPLORATION

5.3 EL. = 1046

MAGNETICS

	U.S. %	U.S. TOT. %	Fe %	UNITS %
A	83	4.2	3.5	24.1	84
B	78	6.7	5.2	26.4	137
C	58	8.1	4.7	12.3	58
D	55	12.0	6.6	17.2	114
E	62	15.2	9.4	19.5	183
Avg.	67	8.8	5.9	19.6	115

Fe UNITS NW 1/4 174

4.2 EL. = 1080

MAGNETICS

	U.S. %	U.S. TOT. %	Fe %	UNITS %
A	74	6.6	4.9	30.2	148
B	75	1.7	1.3	17.3	22
C	76	6	5	25.4	13
D	73	4	.3	28.6	09
E	83	4	.3	31.8	10
Avg.	76	1.8	1.4	27.6	40

Fe UNITS NE 1/4 178

4.3 EL. = 1163

MAGNETICS

	U.S. %	U.S. TOT. %	Fe %	UNITS %	U.S. H_2O %
A	53	14.6	7.7	15.6	120	2.9
B	58	17.5	10.1	19.3	195	1.7
C	55	20.2	11.1	29.1	323	1.2
D	52	15.6	8.1	18.2	147	2.4
E	60	15.2	9.1	16.4	149	2.1
Avg.	56	16.6	9.2	20.3	187	2.1

5.6 EL. = 1087

MAGNETICS

	U.S.	U.S. TOT.	Fe	UNITS
A	71	13.5	9.6	30.5	293
B	60	20.8	12.5	24.7	309
C	52	22.4	11.6	22.2	258
D	71	18.2	12.9	22.5	290
E	63	23.0	14.5	22.4	325
Avg.	63	19.4	12.2	24.1	295

Fe UNITS SW 1/4 236

4.5 EL. = 1123

MAGNETICS

	TiO_2	U.S.	U.S. TOT	Fe	UNITS	U.S. H_2O
A	1.47	51	20.4	10.4	12.3	128	2.0
B	2.86	58	18.1	10.5	24.5	257	1.8
C	1.06	53	27.8	14.7	18.3	264	2.9
D	4.06	64	14.2	9.1	32.9	299	.5
E	3.10	62	16.4	10.2	26.1	266	1.0
Avg.	2.60	58	19.0	10.9	22.2	244	1.6

Fe UNITS SE 1/4 227

4.6 EL. = 1136

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS
A	79	11.2	8.8	32.2	283
B	75	8.9	6.7	31.4	210
C	73	8.9	6.5	38.1	248
D	74	9.0	6.7	36.2	243
E	75	8.8	6.6	33.8	223
Avg.	75	9.4	7.1	34.2	242

5.9 EL. = 1083

MAGNETICS

	U.S.	U.S.	TOT.	Fe	UNITS	U.S. H_2O
A	75	14.6	10.9	20.0	218	.9
B	60	19.7	11.8	20.6	243	4.3
C	61	19.4	11.8	17.6	208	5.1
D	81	8.3	6.7	29.6	198	1.6
E	53	15.1	8.0	26.2	210	1.9
Avg.	66	14.9	9.8	21.9	215	2.6

4.8 EL. = 1127

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS
A	59	19.3	11.4	22.1	252
B	59	15.3	9.0	17.3	156
C	62	16.1	10.0	26.9	269
D	59	14.4	8.5	22.7	193
E	80	4.5	9.6	20.2	73
Avg.	64	13.3	8.5	22.2	189

4.9 EL. = 1163

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS
A	65	17.8	11.6	32.9	382
B	66	25.7	17.0	35.2	598
C	47	9.4	4.4	13.8	61
D	63	4.2	2.6	12.5	32
E	49	14.0	6.9	12.5	86
Avg.	58	14.6	8.5	27.3	232

DIRTY MAGNETIC CONCENTRATES

	Composite # 4.3			Composite # 4.5			Composite # 59			Avg Sec. 4		
	Dirty Conc.	Mag. Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot	Dirty Conc.	Mag. Rej.	U.S. Tot.	Dirty Conc.	Mag Rej	U.S. Tot.
% Rec. U.S.	15.9	84.1	100.0	19.2	80.8	100.0	14.2	85.8	100.0	16.4	83.6	100.0
on Total	8.9	47.1	56.0	11.1	46.9	58.0	9.4	56.6	66.0	9.8	50.2	60.0
Fe	21.23	3.03	5.92	25.10	3.36	7.53	24.47	3.06	6.10	23.60	3.15	6.50
Ph	.264	—	—	.212	—	—	.251	—	—	.242	—	—
Mn	.22	—	—	.38	—	—	.26	—	—	.29	—	—
SiO_2	41.12	—	—	39.77	—	—	39.31	—	—	40.07	—	—
Al_2O_3	8.00	—	—	8.20	—	—	9.20	—	—	8.47	—	—
Sul.	.006	—	—	.007	—	—	.007	—	—	.007	—	—
TiO_2	2.50	.62	.92	3.07	1.05	1.44	3.21	.57	.94	2.93	.75	1.10

SEC. 4 { Fe Units 195 Moisture 2.1 %
lbs/cu.ft 121 Caliche 0 %

CaO 1.73
MgO .72

DIRTY CONCENTRATES CONVERSION FACTOR

80 MESH GRIND

	Clean Conc.	Tails	Slime	Total D C
% Rec. U.S.	—	—	—	—
on Total	32.0	42.4	25.6	100.0
Fe	64.02	5.91	5.75	24.46
Ph	.066	—	—	
Mn	.24	—	—	—
SiO_2	4.47	—		—
Al_2O_3	1.02	—		—
Sul.	.006	—		—
TiO_2	2.00	.70	1.16	2.51

SECTION #4

Distribution of Values

	Percentage Weight	Fe	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	40.0	3.34	-	134			25.2
U.C.	60.0	6.64	1.10	398			74.8
Total Sands	100.0	5.32	-	532			100.0

	Percentage Fraction	Fe	TiO2	Weight % of Whole				
O.S.Total	100.0	3.34	-	40.0	134			
Magnetic	24.0	7.34	-	9.6		71		13.4
Non-Mag.	76.0	2.08	-	30.4		63		11.8
Dry Mag.Heads	100.0	6.64	1.10	60.0	398			
Non-Mag.Rej.	83.6	3.15	.75	50.2		158		29.7
D. C. Rec'y	16.4	24.46	2.51	9.8			240	45.1
Mill Heads	100.0	24.46	2.51	9.8	240			
Tails	42.4	5.91	.70	4.2		26		4.9
Slime	25.6	5.75	1.16	2.5		15		2.8
80 Mesh Conc.	32.0	64.02	2.00	3.1			199	37.4

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y. %	Fe	TiO2	Non-Mag. Reject. %	Fe	TiO2	Total 6 Mesh U.S. %	Fe	TiO2
On 8	7.8	6.63	.76	6.1	1.60	.61	6.4	2.58	.64
10	19.5	5.99	.81	13.3	1.60	.68	14.3	2.55	.71
14	15.9	8.62	1.35	13.5	2.08	.46	13.9	3.26	.62
20	12.7	16.84	2.24	11.7	2.92	.50	11.8	4.46	.80
40	24.3	39.67	4.07	22.5	3.03	.85	22.8	9.22	1.39
80	15.6	44.86	3.01	20.3	3.35	.88	19.6	8.62	1.15
100	1.9	52.04	.90	1.5	3.51	.63	1.5	13.00	.68
200	1.5	50.77	1.20	7.6	3.35	.73	6.6	5.03	.75
-200	.8	28.58	1.37	3.5	3.27	.45	3.1	4.38	.49
Total	100.0	23.81	2.22	100.0	2.60	.70	100.0	5.96	.94

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y.	Fe.	Ph.	Mn.	TiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	32.0%	64.02	.066	.24	4.47	1.02	.006	2.00	1.73	.72
150 "	30.6%	66.57	.048	.18	3.02	1.30	.006	1.05	1.22	.60

40 " No Test made.

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 4, T8S, R12E, assayed as follows:

Gold - Trace
Silver - 0.05 oz. per ton

Spectrographic analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Potassium	Nickel
Aluminum	Magnesium	Sodium	Copper
Silicon	Iron		Molybdenum
	Titanium		Chromium
			Strontium
			Lead
			Barium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION 5, T-8-S, R-12-E.

MURMANILL EXPLORATION

* 5.1 EL. = 970

MAGNETICS

	U.S. %	U.S. %	TOT. %	Fe %	UNITS %
A	59	9.8	5.8	13.8	80
B	61	7.9	4.8	26.8	129
C	61	7.7	4.7	26.9	126
D	78	8.2	6.4	27.2	174
E	62	6.0	3.7	23.9	88
Avg.	64	7.9	5.1	23.5	119

Fe UNITS NW 1/4 144

* 5.2 EL. = 1009

MAGNETICS

	U.S. %	U.S. %	TOT. %	Fe %	UNITS %
A	79	8.0	6.3	24.1	152
B	61	11.2	6.8	24.1	164
C	55	12.9	7.1	23.7	168
D	64	14.2	9.1	29.8	271
E	60	11.2	6.7	25.9	174
Avg.	64	11.3	7.2	25.8	186

Fe UNITS NE 1/4 161

* 5.3 EL. = 1046

MAGNETICS

	U.S. %	U.S. %	TOT. %	Fe %	UNITS %	U.S. H_2O %
A	83	4.2	3.5	24.1	84	1.9
B	78	6.7	5.2	26.4	137	2.2
C	58	8.1	4.7	12.3	58	2.8
D	55	12.0	6.6	17.2	114	2.0
E	62	15.2	9.4	19.5	183	1.5
Avg.	67	8.8	5.9	19.6	115	2.1

Caliche 2.0 Ft.

* 5.4 EL. = 1007

MAGNETICS

	U.S.	U.S.	TOT.	Fe	UNITS
A	75	8.4	6.3	20.5	129
B	81	6.6	5.3	26.7	142
C	59	15.0	8.8	21.1	186
D	63	17.7	11.2	20.7	232
E	71	15.5	11.0	30.9	340
Avg.	70	12.2	8.5	24.1	206

Fe UNITS SW 1/4 217

* 5.5 EL. = 1043

MAGNETICS

	TiO_2	U.S.	U.S.	TOT.	Fe	UNITS	U.S. H_2O
A	2.2	66	8.9	5.9	26.0	153	1.0
B	1.3	67	17.0	11.4	18.4	210	1.5
C	3.0	60	18.0	10.8	24.7	267	1.7
D	2.9	60	13.1	7.9	24.7	195	1.3
E	1.8	64	18.1	11.6	19.4	225	2.4
Avg.	2.2	63	15.0	9.5	22.1	210	1.6

Fe UNITS SE 1/4 289

* 5.6 EL. = 1087

MAGNETICS

	U.S.	U.S.	TOT.	Fe	UNITS
A	71	13.5	9.6	30.5	293
B	60	20.8	12.5	24.7	309
C	52	22.4	11.6	22.2	258
D	71	18.2	12.9	22.5	290
E	63	23.0	14.5	22.4	325
Avg.	63	19.4	12.2	24.1	295

Caliche 1.25 Ft

ASSUMED DATUM 1000 Ft
B.C. S.W. Cor.

* 5.7 EL. = 1000

MAGNETICS

	U.S.	U.S.	TOT.	Fe	UNITS	U.S. H_2O
A	54	13.8	7.4	29.4	218	1.9
B	CALICHE ---	NO	SAMPLE	-		—
C	46	13.9	6.4	26.5	170	2.7
D	49	14.0	6.9	28.1	194	2.5
E	60	19.0	11.4	23.0	262	3.4
Avg.	52	15.4	8.0	26.3	211	2.6

Caliche 5.0 Ft.

* 5.8 EL. = 1039

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS
A	68	23.2	15.8	32.0	506
B	71	21.6	15.3	36.7	562
C	59	15.8	9.3	26.4	248
D	64	32.5	20.8	36.4	757
E	59	16.7	9.8	22.0	216
Avg.	64	22.1	14.2	32.2	458

* 5.9 EL. = 1083

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS
A	75	14.6	10.9	20.0	218
B	60	19.7	11.8	20.6	243
C	61	19.4	11.8	17.6	208
D	81	8.3	6.7	29.6	198
E	53	15.1	8.0	26.2	210
Avg.	66	14.9	9.8	21.9	215

DIRTY CONCENTRATES

DIRTY MAGNETIC CONCENTRATES

	Composite *5.3			Composite *5.5			Composite *5.7			Avg. Sec. 5		
	Dirty Conc.	Mag. Rej.	U.S. Tot	Dirty Conc.	Mag. Rej.	U.S. Tot.	Dirty Conc.	Mag. Rej.	U.S. Tot.	Dirty Conc.	Mag. Rej.	U.S. Tot
% Rec. U.S.	8.8	91.2	100.0	14.7	85.3	100.0	14.6	85.4	100.0	12.7	87.3	100.0
on Total	5.9	61.1	67.0	9.3	53.7	63.0	7.6	44.4	52.0	7.6	53.1	60.7
Fe	21.28	2.98	4.59	23.79	2.25	5.41	26.60	3.38	6.77	23.89	2.87	5.55
Ph	.195	—	—	.267	—	—	.249	—	—	.237	—	—
Mn	.26	—	—	.17	—	—	.30	—	—	.24	—	—
SiO_2	45.91	—	—	39.18	—	—	37.47	—	—	40.85	—	—
Al_2O_3	10.63	—	—	11.80	—	—	8.75	—	—	10.39	—	—
Sul.	.007	—	—	.009	—	—	.006	—	—	.007	—	—
TiO_2	1.62	.49	.59	2.10	1.00	1.16	3.05	.76	1.09	2.26	.75	.94

SEC (Fe Units 2.24 Moisture 2.1 %

CONVERSION FACTOR

80 MESH GRIND

	Clean Conc	Tails	Slime	Total D.C
% Rec. U.S.	—	—	—	—
on Total	28.0	43.6	28.4	100.0
Fe	66.35	7.68	6.72	23.83
Ph	.063	—	—	—
Mn	.22	—	—	—
SiO_2	2.99	—	—	—
Al_2O_3	1.80	—	—	—
Sul.	.006	—	—	—
TiO_2	1.40	2.17	1.27	1.70
CaO	2.23	—	—	—

SECTION #5

Distribution of Values

	Percentage Weight	Fe	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	39.3	2.93	.64	115			25.5
U.S.	60.7	5.53	.94	336			74.5
Total Sands	100.0	4.51	.82	451			100.0

	Percentage Fraction	Fe	TiO2	Weight % of Whole				
O.S.Total	100.0	2.93	.64	39.3	115			
Magnetic	17.5	5.44	.80	6.9		37		8.2
Non-Mag.	82.5	2.40	.60	32.4		78		17.3
Dry Mag.Heads	100.0	5.53	.94	60.7	336			
Non-Mag.Rej.	87.3	2.87	.75	53.1		155		34.4
D. C. Rec'y	12.7	23.83	1.70	7.6			181	40.1
Mill Heads	100.0	23.83	1.70	7.6	181			
Tails	43.6	7.68	2.17	3.3		26		5.8
Slime	28.4	6.72	1.27	2.2		16		3.5
80 Mesh Conc.	28.0	66.35	1.40	2.1			139	30.8

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y. %	Fe	TiO2	Non-Mag. Reject. %	Fe	TiO2	Total 6 Mesh U.S %	Fe	TiO2
On 8	5.8	4.88	.67	5.5	2.56	.25	5.6	2.87	.31
10	13.9	6.40	1.38	11.5	1.76	.32	11.8	2.46	.48
14	18.4	9.28	2.53	14.4	1.92	.51	14.9	3.08	.83
20	14.4	16.65	1.84	12.6	2.08	.53	12.9	4.16	.72
40	26.0	36.82	4.52	21.2	2.72	.60	21.8	7.90	1.20
80	16.5	49.15	3.24	16.5	3.68	1.34	16.5	9.48	1.58
100	2.1	51.71	1.92	2.8	3.84	1.34	2.7	8.57	1.40
200	1.6	44.98	1.55	7.4	3.36	.64	6.6	4.62	.67
-200	1.3	22.25	1.26	8.1	3.28	.50	7.2	3.72	.52
Total	100.0	25.06	2.75	100.0	2.69	.66	100.0	5.54	.93

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe	Ph.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	28.0%	66.35	.063	.22	2.99	1.80	.006	1.40	2.23	.80
150 "	28.1%	66.35	.047	.20	3.11	2.20	.008	.91	1.90	.61
40 "	37.7%	61.47	.204	- -	4.58	2.82	- -	3.78	- -	- -

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 5, T8S, R12E assayed as follows:

Gold - Trace
Silver - 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Sodium	Lead
Aluminum	Iron	Chromium	Copper
Silicon	Titanium		Molybdenum
	Magnesium		Strontium
			Nickel
			Zinc
			Silver

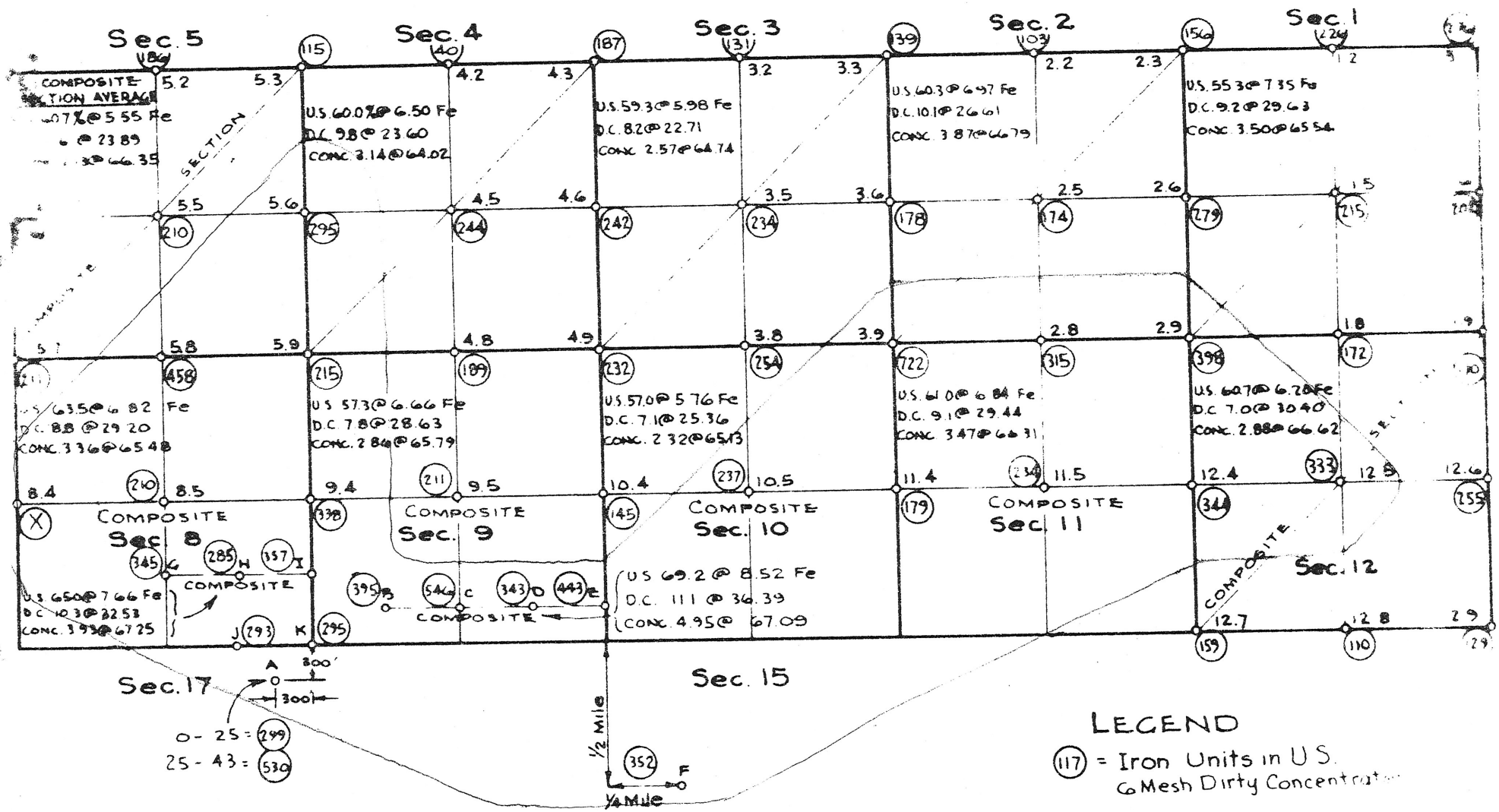
George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTIONS 1 TO 5 AND SECTIONS 8 TO 12 AND PORTION OF SECTIONS 15 & 17, T-8-S, R-12-E.

MURMANILL EXPLORATION



LEGEND

(117) = Iron Units in U.S. 6 Mesh Dirty Concentrate

Possible Pit Area 5 sq miles
sample depth 25'
44
Tonnage Available 8,214,400 Tons

N½ SECTION 8, T-8-S, R-12-E.

MURMANILL EXPLORATION

\# 5.7 EL. = 1000

	MAGNETICS US	US	TOT	FE	UNITS
	%	%	%	%	%
A	54	13.8	7.4	29.4	218
B	CALICHE NO SAMPLE				
C	46	13.9	6.4	26.5	170
D	49	14.0	6.9	28.1	194
E	60	19.0	11.4	23.0	262
AVG	52	15.4	8.0	26.3	211

Fe Units NW ¼ 293

\# 5.8 EL. = 1039

	MAGNETICS US	US	TOT	FE	UNITS
	%	%	%	%	%
A	68	23.2	15.8	32.0	506
B	71	21.6	15.3	36.7	562
C	59	15.8	9.3	26.4	248
D	64	32.5	20.8	36.4	757
E	59	16.7	9.8	22.0	216
AVG	64	22.1	14.2	32.2	458

Fe Units NE ¼ 305

\# 5.9 EL. = 1083

	US	MAGNETICS US	TOT	FE	UNITS	US H_2O
	%	%	%	%	%	%
A	75	14.6	10.9	20.0	218	.9
B	60	19.7	11.8	20.6	243	4.3
C	61	19.4	11.8	17.6	208	5.1
D	81	8.3	6.7	29.6	198	1.6
E	53	15.1	8.0	26.6	210	1.9
AVG	66	14.9	9.8	21.9	215	2.6

\# 8.4 EL. = ——

	MAGNETICS US	US	TOT	FE	UNITS
A					
B	NOT DRILLED				
C	a/c IN GARPAC				
D	AREA				
E					
AVG					

\# 8.5 EL. = ?

	TiO_2	US	MAGNETICS US	TOT	FE	UNITS	US H_2O
A	208	73	7.5	5.5	35.5	195	4
B	362	69	15.1	11.1	30.2	335	1.2
C	303	65	17.6	11.4	19.0	217	2.6
D	235	62	14.8	9.2	24.1	222	2.4
E	270	61	8.7	5.3	15.4	82	4.3
AVG	275	66	12.7	8.5	24.7	210	2.1

\# 9.4 EL. = 1080

	US	MAGNETICS US	TOT	FE	UNITS	U.S. H_2O
A	68	10.5	7.2	48.0	346	1.0
B	66	14.2	9.4	27.6	259	1.4
C	65	18.6	12.1	32.5	393	1.2
D	53	28.8	15.3	41.4	633	2.5
E	51	6.7	3.4	16.7	57	.73
AVG	61	15.6	9.5	35.6	338	2.5

DIRTY MAGNETIC CONCENTRATES

	Composite 8.4 Dirty Conc.	Mag. Rej.	U.S. Tot.	Composite 8.5 Dirty Conc.	Mag. Rej.	U.S. Tot.	Composite 9.4 Dirty Conc.	Mag. Rej.	U.S. Tot.	Avg. Con Sec 8 Dirty Conc.	Mag. Rej.	U.S. Tot.
% Rec. U.S. on Total	NOT DRILLED			12.4	87.6	100.0	15.2	84.8	100.0	13.8	86.2	100.0
				8.2	57.8	66.0	9.3	51.7	61.0	8.8	54.7	63.5
Fe				24.18	3.06	5.68	34.41	3.22	7.96	29.20	3.14	6.82
Ph				.207	—	—	.084	—	—	.146	—	—
Mn				.23	—	—	.33	—	—	.28	—	—
SiO_2				39.55	—	—	28.75	—	—	34.15	—	—
Al_2O_3				6.52	—	—	4.50	—	—	5.51	—	—
Sul				.008	—	—	.009	—	—	.009	—	—
TiO_2				1.21	.72	.78	2.86	.84	1.15	2.03	.78	.96

N½ SEC. 8
- Fe Units 2.86
- lbs./cu ft. 112
- Mag Rec 3.36

Moisture 2.3 %
Caliche 0
Boulders 0

DIRTY CONCENTRATES CONVERSION FACTOR

	80 MESH GRIND Clean Conc	Tails	Slime	Total D.C
	—	—	—	—
	38.2	34.8	27.0	100.0
Fe	65.48	6.25	5.93	28.79
Ph	.078	—	—	—
Mn	.20	—	—	—
SiO_2	3.70	—	—	—
Al_2O_3	1.34	—	—	—
Sul	.008	—	—	—
TiO_2	1.56	2.87	1.33	1.95
CaO	.65	—	—	—
MgO	.23	—	—	—

O. A. SUNDNESS

SECTION #8

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	43.0	2.82	- -	121			24.7
U.S.	57.0	6.47	.87	369			75.3
Total Sands	100.0	4.90	- -	490			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of whole				
O.S.Total	100.0	2.82	- -	43.0	121			
Magnetic	14.4	10.09	- -	6.2		62		12.7
Non-Mag.	85.6	1.60	- -	36.8		59		12.0
Dry Mag.Heads	100.0	6.47	.87	57.0	369			
Non-Mag.Rej.	86.7	3.05	.71	49.4		150		30.6
D.C.Rec'y	13.3	28.79	1.95	7.6			219	44.7
Mill Heads	100.0	28.79	1.95	7.6	219			
Tails	34.8	6.25	2.87	2.6		16		3.3
Slime	27.0	5.93	1.33	2.1		13		2.7
80 Mesh Conc.	38.2	65.48	1.56	2.9			190	38.7

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO2	Non-Mag.Reject %	Non-Mag.Reject Fe	Non-Mag.Reject TiO2	Total 6 Mesh U. S. %	Total 6 Mesh U. S. Fe	Total 6 Mesh U. S. TiO2
On 8	5.2	5.92	.66	4.6	1.68	.40	4.6	2.29	.44
10	15.6	7.28	.85	11.0	1.60	.46	11.6	2.58	.53
14	14.0	10.57	2.02	11.4	1.76	.43	11.7	3.11	.67
20	11.4	18.97	3.20	10.8	2.00	.62	10.9	4.29	.97
40	26.2	44.50	5.12	19.5	2.96	1.10	20.4	9.81	1.76
80	21.6	56.91	2.75	16.0	4.40	1.71	16.7	13.10	1.88
100	2.3	57.79	1.64	3.3	3.84	1.60	3.2	8.95	1.60
200	2.1	52.99	1.66	12.2	3.36	.81	10.9	4.57	.83
-200	1.6	20.49	1.27	11.2	3.52	.70	10.0	3.86	.71
Total	100.0	31.81	2.84	100.0	2.88	.90	100.0	6.60	1.15

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O3	Sul	TiO2	CaO	MgO
80 Mesh	38.2%	65.48	.078	.20	3.70	1.34	.008	1.56	.65	.23
150 "	37.5%	67.65	.042	.20	2.66	1.52	.006	.83	.71	.25

40 No Test made.

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 8, T8S, R12E, assayed as follows:

Gold - Trace
Silver - 0.06 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Magnesium	Chromium	Strontium
Aluminum	Iron	Potassium	Lead
Silicon	Titanium		Nickel
	Manganese		Silver
	Sodium		Zinc
			Copper
			Molybdenum
			Barium
			Zirconium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SE¼ OF SECTION 8 T-8-S, R-12-E.

MURMANILL EXPLORATION

\# G EL = ?

	MAGNETICS					
	U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
	%	%	%	%	%	%
A	81	8.2	6.6	35.1	232	.7
B	66	14.9	9.8	30.5	300	1.0
C	55	11.5	6.3	23.4	147	1.8
D	65	20.1	13.1	21.4	280	3.2
E	74	24.2	17.9	37.3	668	3.5
F	67	20.1	13.5	32.7	441	4.0
Avg.	68	16.5	11.2	30.8	345	2.3

\# H EL = ?

	MAGNETICS					
	U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
	%	%	%	%	%	%
A	77	10.3	7.9	26.3	208	1.3
B	62	20.8	12.9	24.8	320	2.0
C	57	22.3	12.7	18.9	240	3.6
D	53	28.2	14.9	28.5	425	3.0
E	54	13.3	7.2	19.5	138	2.9
F	71	12.2	8.7	42.9	378	9
Avg.	62	17.2	10.7	26.5	285	2.2

\# I EL = ?

	MAGNETICS					
	U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
	%	%	%	%	%	%
A	65	11.1	7.2	38.5	277	.5
B	62	12.6	7.8	32.9	257	1.2
C	66	18.5	12.2	22.3	272	3.2
D	58	20.3	11.8	25.6	302	2.4
E	59	18.3	10.8	40.4	436	.9
F	77	20.5	15.8	37.9	599	1.8
Avg.	65	16.9	10.9	32.7	357	1.6

DIRTY CONCENTRATES

MAGNETIC CONCENTRATES — CONVERSION FACTOR

	COMPOSITE G-H-I			80 MESH GRIND			
	DIRTY CONC.	MAG. REJ.	U.S. TOT	CLEAN CONC.	TAILS	SLIME	TOTAL D.C.
% Rec. U.S.	15.9	84.1	100.0	—	—	—	—
on Total	10.3	54.7	65.0	38.2	35.6	26.2	100.0
Fe	32.53	2.96	7.66	67.25	10.26	9.54	31.84
Pb	.234		—	.069	—	—	—
Mn	.20		—	.16		—	—
SiO_2	33.10	—	—	2.05	—	—	—
Al_2O_3	4.91	—	—	.90	—	—	—
Sul	.007	—	—	.005	—	—	—
TiO_2	2.65	1.18	1.46	1.40	4.70	2.63	2.90
			CaO	.90	—	—	—
			MgO	.34	—	—	—

SE¼ Sec 8

Fe Units 329 Moisture 2.0 %

lbs/cuft 120 Caliche 0 %

Mag. Rec 39.3 Boulders 0 %

O.A SUNDNESS

SE 1/4 SECTION #8
Holes G - H - I

Distribution of Values

	Percentage Weight	Fe.	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	35.0	2.84	- -	99			17.1
U.S.	65.0	7.39	1.64	480			82.9
Total Sands	100.0	5.79	- -	579			100.0

	Percentage Fraction	Fe.	TiO2	Weight % of Whole			
O.S.Total	100.0	2.84	- -	35.0	99		
Magnetic	14.7	10.07	- -	5.1		51	8.8
Non-Mag	85.3	1.60	- -	29.9		48	8.3
Dry Mag.Heads	100.0	7.39	1.64	65.0	480		
Non-Mag.Rej.	84.2	2.80	1.41	54.7		153	26.4
D.C.Rec'y.	15.8	31.84	2.90	10.3		327	56.5
Mill Heads	100.0	31.84	2.90	10.3	327		
Tails	35.6	10.26	4.70	3.7		38	6.6
Slime	26.2	9.54	2.64	2.7		26	4.5
80 Mesh Conc.	38.2	67.25	1.40	3.9		263	45.4

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Fe.	TiO2	Non-Mag.Reject %	Fe.	TiO2	Total 6 Mesh U.S %	Fe.	TiO2
On 8	6.7	5.52	.90	6.4	1.68	.46	6.5	2.31	.53
10	14.3	7.75	1.52	12.9	1.52	.46	13.2	2.61	.65
14	14.3	10.63	2.06	13.1	2.16	.40	13.3	3.60	.68
20	11.7	20.30	3.20	11.7	2.00	.55	11.7	4.92	.97
40	28.3	44.28	4.44	20.4	3.68	1.71	21.7	12.17	2.28
80	20.2	54.67	2.57	16.9	4.40	2.40	17.4	13.72	2.43
100	2.1	56.27	1.91	3.4	4.56	1.68	3.2	9.95	1.70
200	1.6	48.84	1.80	8.4	4.40	1.12	7.3	6.02	1.14
-200	.8	26.14	1.93	6.8	4.00	.63	5.7	4.51	.66
Total	100.0	31.12	2.81	100.0	3.11	1.15	100.0	7.59	1.42

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO.
Mesh	38.2%	67.25	.069	.16	2.05	.90	.005	1.40	.90	.34
"	38.8%	68.05	.046	.44	1.76	.81	.009	1.26	.72	.25

No Test made.

N½ SECTION 9, T-8-S, R-12-E.

MURMANILL EXPLORATION

\# 5.9 EL. = 1083

		MAGNETICS US %	US %	TOT %	FE %	UNITS %
5	A	75	14.6	10.9	20.0	218
10	B	60	19.7	11.8	20.6	243
15	C	61	19.4	11.8	17.6	208
20	D	81	8.3	6.7	29.6	198
25	E	53	15.1	8.0	26.2	210
	Avg	66	14.9	9.8	21.9	215

Fe Units NW ¼ 238

\# 4.8 EL. = 1127

		MAGNETICS US %	US %	TOT %	FE %	UNITS %
	A	59	19.3	11.4	22.1	252
	B	59	15.3	9.0	17.3	156
	C	62	16.1	10.0	26.9	269
	D	59	14.4	8.5	22.7	193
	E	80	4.5	3.6	20.2	73
	Avg	64	13.3	8.5	22.2	189

Fe Units NE ¼ 194

\# 4.9 EL. = 1163

		MAGNETICS US %	US %	TOT %	FE %	UNITS %	US H_2O %
	A	65	17.8	11.6	32.9	382	1.6
	B	66	25.7	17.0	35.2	598	4.0
	C	47	9.4	4.4	13.8	61	2.7
	D	63	4.2	2.6	12.5	32	2.3
	E	49	14.0	6.9	12.5	86	2.3
	Avg	58	14.6	8.5	27.3	232	2.6

\# 9.4 EL. = 1080

		MAGNETICS US	US	TOT	FE	UNITS	US H_2O
5	A	68	10.5	7.2	48.0	346	1.0
10	B	66	14.2	9.4	27.6	259	1.4
15	C	65	18.6	12.1	32.5	393	1.2
20	D	53	28.8	15.3	41.4	633	2.5
25	E	51	6.7	3.4	16.7	57	7.3
	Avg	61	15.6	9.5	35.6	338	2.5

\# 9.5 EL. = 1125

	TiO_2		MAGNETICS US	US	TOT	FE	UNITS	US H_2O
	158	A	60	14.8	8.9	13.6	121	2.3
	214	B	61	11.1	6.8	27.8	189	1.2
	328	C	57	18.0	10.3	34.7	357	9
	233	D	37	17.6	6.5	42.6	277	2.1
	202	E	57	13.0	7.4	14.7	109	4.3
	226	Avg	54	14.6	8.0	26.4	211	2.2

\# 10.4 EL. = 1162

		MAGNETICS US	US	TOT	FE	UNITS	US. H_2O
	A	59	10.7	6.3	22.4	141	1.4
	B	57	14.1	8.0	19.5	156	1.2
	C	62	16.2	10.1	27.1	274	1.0
	D	57	7.1	4.0	17.4	70	1.5
	E	50	8.8	4.4	19.2	84	1.2
	Avg	57	11.5	6.6	22.1	145	1.3

DIRTY MAGNETIC CONCENTRATES

	Composite 9.4 Dirty Mag Conc	Rej	US Tot	Composite 9.5 Dirty Mag Conc	Rej	US Tot	Composite 10.4 Dirty Mag Conc	Rej	US Tot	Avg. on Sec 9 Dirty Mag Conc	Rej	US Tot
% Rec US	15.2	84.8	100.0	14.3	85.7	100.0	11.5	88.5	100.0	13.7	86.3	100.0
on Total	9.3	51.7	61.0	7.7	46.3	54.0	6.6	50.4	57.0	7.8	49.5	57.3
Fe	34.41	3.22	7.96	29.05	2.99	6.72	22.44	3.07	5.30	28.63	3.09	6.66
Ph	.084			.234	—	—	.237		—	.185		
Mn	.33	—	—	.24	—	—	.24	—	—	.27	—	—
SiO_2	28.75	—		37.01	—	—	44.33	—	—	36.70	—	—
Al_2O_3	4.50		—	7.20	—	—	9.80	—	—	7.16	—	—
Sul	.009	—	—	.007	—	—	.006	—	—	.007	—	—
TiO_2	2.86	.84	1.15	2.90	.70	1.01	2.09	.87	1.01	2.62	.80	1.06

N½ SEC 9
- Fe Units 22
- lbs/cu ft. 119
- Mag Rec 2.86 %

Moisture 2.0 %
Caliche 0
Boulders 0

DIRTY CONCENTRATES

CONVERSION FACTOR

80 MESH GRIND	Clean Conc.	Tails	Slime	Total D C
	—	—	—	—
	36.7	38.6	24.7	100.0
	5.79	8.48	8.00	29.39
	.063	—	—	—
	.20	—	—	—
	2.99	—	—	—
	1.05	—	—	—
	.007	—	—	—
	1.01	4.10	2.00	2.45
CaO	.80	—	—	—
MgO	.40	—	—	—

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 9, T8S, R12E assayed as follows:

Gold - Trace
Silver - less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Chromium	Strontium
Aluminum	Iron	Potassium	Nickel
Magnesium	Titanium	Sodium	Copper
Silicon			Molybdenium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION #9

Distribution of Values

	Percentage Weight	Fe	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	42.7	3.39	- -	145			27.9
U.S.	57.3	6.53	.69	374			72.1
Total Sands	100.0	5.19	- -	519			100.0

	Percentage Fraction	Fe	TiO2	Weight % of Whole				
O.S.Total	100.0	3.39	- -	42.7	145			
Magnetic	13.3	8.80	- -	5.7		50		9.6
Non-Mag	86.7	2.56	- -	37.0		95		18.3
Dry Mag.Heads	100.0	6.53	.69	57.3	374			
Non.Mag.Rej.	86.3	2.90	.41	49.4		142		27.4
D.C.Rec'y	13.7	29.39	2.44	7.9			232	44.7
Mill Heads	100.0	29.39	2.44	7.9	232			
Tails	38.6	8.48	4.10	3.0		25		4.8
Slime	24.7	8.00	2.00	2.0		16		3.1
80 Mesh Conc.	36.7	65.79	1.01	2.9			191	36.8

Sieve Test on Composite of a 6 Mesh U. S.

	Dirty Conc. Rec'y %	Fe	TiO2	Non-Mag. Reject %	Fe	TiO2	Total 6 Mesh U. S. %	Fe	TiO2
On 8	7.0	5.52	.98	6.2	1.61	.50	6.3	2.19	.57
10	16.7	6.23	.90	12.8	2.10	.50	13.3	2.79	.57
14	13.7	11.03	2.08	12.4	2.34	.44	12.6	3.61	.68
20	11.2	20.30	3.73	11.1	2.34	.40	11.6	4.77	.85
40	25.7	44.68	4.48	19.2	4.11	.50	20.0	11.06	1.18
80	20.1	54.91	2.65	16.1	2.82	.93	16.7	11.27	1.21
100	2.2	54.43	1.60	3.2	4.43	1.64	3.1	9.32	1.64
200	2.2	29.59	2.43	9.5	3.95	.47	8.5	4.85	.54
-200	1.2	24.38	1.74	9.5	3.47	.50	8.4	3.89	.52
Total	100.0	29.87	2.72	100.0	3.01	.58	100.0	6.61	.87

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	36.7%	65.79	.063	.20	2.99	1.05	.007	1.01	.80	.40
150 "	36.1%	67.23	.047	.18	3.63	1.04	.008	.79	.70	.30
200 "	No Test made.									

S¼ OF SECTION 9, T-8-S, R-12-E.

MURMANILL EXPLORATION

* B EL:

MAGNETICS

	U.S.	U S	TOT	FE	UNITS	U.S H_2O
	%	%	%	%	%	%
A	80	10 1	8 1	43 2	350	5
B	57	16 2	9 2	38.6	355	1 0
C	69	18.9	13 0	46 6	606	5
D	69	17 8	12 3	39.2	482	1 0
E	63	11.6	7 3	24 8	181	1 5
AVG.	68	14.8	10 0	39.6	395	.9

* C EL:

MAGNETICS

	U S	U S	TOT.	FE	UNITS	U S H_2O
	%	%	%	%	%	%
A	74	10 1	7 5	38.3	287	.9
B	65	17 5	11.4	40 0	456	1.4
C	76	37 7	28 6	53.8	1539	1.3
D	65	6 1	4 0	30.3	121	2.4
E	76	13.2	10.0	32.7	327	.8
AVG.	71	17.3	12.3	44.4	546	1.3

* D EL:

MAGNETICS

	U S	U.S	TOT	FE	UNITS	U S H_2O
	%	%	%	%	%	%
A	78	12.5	9.7	37.4	363	.7
B	64	17.3	11.1	34.1	379	.6
C	75	19.9	14.9	27.2	405	2.8
D	64	18.9	12.1	27.9	338	2.8
E	67	14.1	9.4	23.4	220	2.4
AVG.	69	16.5	11.4	29.8	343	1.8

* E EL.:

MAGNETICS

	U S	U S	TOT	FE	UNITS	
	%	%	%	%	%	
A	79	10 8	8 5	45 1	383	
B	68	18 1	12 3	38 1	469	.4
C	69	32 2	22 2	41 9	930	1.4
D	67	15.0	10.0	25 1	251	2.6
E	63	13 8	8 7	20.7	180	2.4
AVG.	69	17 9	12 3	35.9	443	1.5

DIRTY MAGNETIC CONCENTRATES — DIRTY CONCENTRATES CONVERSION FACTOR

	COMPOSITE B-C-D&E			80 MESH GRIND			
	DIRTY CONC.	MAG REJ.	U.S TOT	CLEAN CONC	TAILS	SLIME	TOTAL D. C.
%Rec U.S.	16 0	84 0	100.0	—	—	—	—
on TOTAL	11 1	58 1	69.2	44 6	32.2	23.2	100.0
Fe	36.39	3.21	8 52	67 09	11.54	8 98	35.72
Ph	.258	—	—	.076	—	—	—
Mn	22	—	—	.17	—	—	—
SiO_2	29.91	—	—	2 30	—	—	—
Al_2O_3	7 42	—	—	.84	—	—	—
Sul	007	—	—	067	—	—	—
TiO_2	2 49	.85	.75	1 34	3 83	2 70	2 46
CaO				.51	—	—	—
MgO				25	—	—	—

S¼ Sec. 9 — Fe Units 432 — lbs/cu ft 115 — Mag. Rec 4 95

Moisture 1.4 %
Caliche 0 %
Boulders 0 %

SOUTH 1/4 OF SECTION #9
Holes B - C - D - E

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	30.8	3.24	- -	100			15.1
U.S.	69.2	8.14	.73	563			84.9
Total Sands	100.0	6.63	- -	663			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of Whole				
O.S.Total	100.0	3.24	- -	30.8	100			
Magnetic	14.2	10.74	- -	4.4		47		7.1
Non-Mag.	85.8	2.00	- -	26.4		53		8.0
Dry Mag.Heads	100.0	8.14	.73	69.2	563			
Non-Mag.Rej.	84.0	2.89	.40	58.1		168		25.3
D.C.Rec'y	16.0	35.72	2.46	11.1			395	59.6
Mill Heads	100.0	35.72	2.46	11.1	395			
Tails	32.2	11.54	3.83	3.6		42		6.4
Slime	23.2	8.98	2.70	2.6		24		3.6
80 Mesh Conc.	44.6	67.09	1.34	4.9			329	49.6

Sieve Test on Composite of 6 Mesh U. S.

		Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO2	Non-Mag. Reject %	Non-Mag. Reject Fe	Non-Mag. Reject TiO2	Total 6 Mesh U.S. %	Total 6 Mesh U.S. Fe	Total 6 Mesh U.S. TiO2
On	8	5.2	5.61	1.47	5.9	1.76	.51	5.8	2.34	.65
	10	12.0	7.37	1.38	12.1	1.52	.51	12.1	2.49	.65
	14	12.0	11.62	2.45	12.7	1.92	.61	12.6	3.46	.90
	20	10.6	23.08	4.70	11.6	1.93	.48	11.4	5.20	1.13
	40	30.8	47.61	6.05	20.5	3.45	.51	22.2	13.58	1.78
	80	24.6	58.27	3.31	16.8	5.05	2.00	18.1	17.11	2.30
	100	2.2	56.75	2.16	3.9	5.29	.92	3.6	10.48	1.04
	200	1.8	52.90	1.96	9.4	4.09	.58	8.1	5.90	.63
	-200	.8	31.90	2.25	7.1	3.89	.54	6.1	4.51	.58
	Total	100.0	36.22	3.81	100.0	3.18	.79	100.0	8.70	1.29

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph	Mn.	SiO2	Al2O3	Sul	TiO2	CaO	MgO
80 Mesh	44.6%	67.09	.076	.17	2.30	.84	.007	1.54	.51	.25
150 "	43.2%	67.81	.043	.16	2.16	1.00	.004	.84	.51	.23

N½ SECTION 10, T-8-S, R-12-E.

MURMANILL EXPLORATION

#4.9 EL. = 1163

		MAGNETICS US %	US %	TOT %	FE %	UNITS %
5	A	65	17.8	11.6	32.9	382
10	B	66	25.7	17.0	35.2	598
15	C	47	9.4	4.4	13.8	61
20	D	63	4.2	2.6	12.5	32
25	E	49	14.0	6.9	12.5	86
	AVG	58	14.6	8.5	27.3	232

Fe Units NW ¼ 217

#3.8 EL. = 1205

		MAGNETICS US %	US %	TOT %	FE %	UNITS %
	A	66	13.0	8.6	27.9	240
	B	63	17.5	11.0	22.7	250
	C	61	15.0	9.1	24.0	218
	D	62	18.4	11.4	29.5	336
	E	48	25.7	12.3	18.3	225
	AVG	60	17.5	10.5	24.2	254

Fe Units NE ¼ 348

#3.9 EL. = 1246

		MAGNETICS US %	US %	TOT %	FE %	UNITS %	US H_2O %
	A	75	19.3	14.5	35.9	521	.6
	B	66	30.5	20.1	47.3	951	1.2
	C	61	35.2	21.5	52.3	1124	.8
	D	71	29.2	20.7	39.3	814	1.4
	E	49	21.6	10.6	18.8	199	4.2
	AVG	64	27.1	17.5	41.3	722	1.5

#10.4 EL. = 1162

		MAGNETICS US	US	TOT	FE	UNITS	U.S. H_2O
5	A	59	10.7	6.3	22.4	141	1.4
10	B	57	14.1	8.0	19.5	156	1.2
15	C	62	16.2	10.1	27.1	274	1.0
20	D	57	7.1	4.0	17.4	70	1.5
25	E	50	8.8	4.4	19.2	84	1.2
	AVG	57	11.5	6.6	22.1	145	1.3

#10.5 EL. = 1210

	TiO_2		MAGNETICS US	US	TOT	FE	UNITS	US H_2O
	160	A	61	15.5	9.5	15.1	143	3.2
	252	B	63	19.0	12.0	29.2	350	1.1
	170	C	59	19.0	11.2	19.3	216	3.7
	177	D	61	8.8	5.4	25.0	135	2.0
	233	E	56	22.5	12.6	27.1	341	3.3
	198	AVG	60	16.9	10.1	23.4	237	3.6

#11.4 EL. = 1245

		MAGNETICS US	US	TOT	FE	UNITS	U.S. H_2O
	A	71	7.2	5.1	30.3	155	2.3
	B	67	9.1	6.1	32.4	198	1.8
	C	72	8.3	6.0	16.7	100	3.0
	D	78	8.7	6.7	30.5	204	3.5
	E	70	9.7	6.8	35.0	238	2.5
	AVG	72	8.6	6.2	29.1	179	2.6

DIRTY MAGNETIC CONCENTRATES

	Composite 10.4			Composite 10.5			Composite 11.4			Avg Cen. Sec. 10		
	Dirty Conc.	Mag. Rej.	U.S. Tot.	Dirty Conc	Mag Rej.	U.S. Tot.	Dirty Conc.	Mag Rej	U.S Tot.	Dirty Conc	Mag Rej.	U.S. Tot.
% Rec. U.S.	11.5	88.5	100.0	16.6	83.4	100.0	8.6	91.4	100.0	12.2	87.8	100.0
on Total	6.6	50.4	57.0	10.0	50.0	60	4.6	49.4	54.0	7.1	49.9	57.0
Fe	22.44	3.07	5.30	22.67	2.97	6.24	30.98	3.37	5.74	25.36	3.14	5.76
Pb	.237	—	—	.210	—	—	.254	—	—	.234	—	—
Mn	.24	—	—	.18	—	—	.21	—	—	.21	—	—
SiO_2	44.33	—	—	18.30	—	—	35.55	—	—	32.73	—	—
Al_2O_3	9.80	—	—	8.75	—	—	7.70	—	—	8.75	—	—
Sul	.006	—	—	.011	—	—	.004	—	—	.007	—	—
TiO_2	2.09	.87	1.01	2.74	.96	1.26	3.22	.95	1.15	2.68	.99	1.14

N½ SEC 10: Fe Units 295; lbs/cu ft. 120; Mag Rec 2.32 %

Moisture 2.5 %; Caliche 0; Boulders 0

DIRTY CONCENTRATES CONVERSION FACTOR

80 MESH GRIND

	Clean Conc.	Tails	Slime	Total D C
% Rec. U.S.	—	—	—	—
on Total	32.7	38.5	28.8	100.0
Fe	65.13	7.83	6.62	26.21
Pb	.075	—	—	—
Mn	.20	—	—	—
SiO_2	3.70	—	—	—
Al_2O_3	1.24	—	—	—
Sul	.007	—	—	—
TiO_2	1.34	3.25	1.56	2.14
CaO	1.00	—	—	—
MgO	.41	—	—	—

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 10, T8S, R12E, assayed as follows:

Gold - nil
Silver - less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Chromium	Strontium	Gallium
Aluminum	Manganese	Nickel	Lead
Silicon	Iron		Zirconium
Sodium	Titanium		Silver ?
Potassium	Magnesium		Molybdenum
			Copper
			Zinc
			Barium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION #10

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO_2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	43.0	2.71	- -	117			26.2
U.S.	57.0	5.80	.97	330			73.8
Total Sands	100.0	4.47		447			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO_2	Weight % of Whole				
O.S.Total	100.0	2.71	- -	43.0	117			
Magnetic	12.3	8.76	- -	5.3		47		10.5
Non-Mag	87.7	1.86	- -	37.7		70		15.7
Dry Mag. Heads	100.0	5.80	.97	57.0	330			
Non.Mag.Rej.	88.3	3.23	.82	50.6		163		36.5
D.C.Rec'y	11.2	26.21	2.14	6.4			167	37.3
Mill Heads	100.0	26.21	2.14	6.4	167			
Tails	38.5	7.83	3.25	2.5		19		4.2
Slime	28.3	6.62	1.56	1.8		12		2.7
80 Mesh Conc.	32.7	65.13	1.34	2.1			136	30.4

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO_2	Non-Mag.Reject %	Non-Mag.Reject Fe	Non-Mag.Reject TiO_2	Total 6 Mesh U.S. %	Total 6 Mesh U.S. Fe	Total 6 Mesh U.S. TiO_2
On 8	8.6	5.81	.60	6.2	1.45	.57	6.5	2.15	.58
10	16.6	6.70	.53	13.0	1.29	.50	12.6	2.15	.50
14	14.6	9.52	.63	12.0	1.78	.54	12.3	2.90	.55
20	12.4	17.51	.90	10.6	2.10	.58	10.8	4.24	.62
40	23.4	35.51	3.04	18.9	2.82	.64	19.4	7.60	1.08
80	17.7	50.36	2.96	17.6	4.04	.60	17.6	9.67	.99
100	2.8	52.30	1.00	4.0	4.52	.61	3.9	8.04	.64
200	2.5	49.15	1.65	8.5	4.28	.85	7.3	6.02	.88
-200	1.4	31.80	1.68	10.2	3.87	.50	9.1	4.38	.52
Total	100.0	25.53	1.31	100.0	2.86	.60	100.0	5.81	.76

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe	Ph	In.	SiO_2	Al_2O_3	Sur.	TiO_2	CaO	MgO
80 Mesh	32.7%	65.13	.075	.20	3.70	1.24	.007	1.34	1.00	.41
150 "	31.0%	67.31	.039	.16	2.36	1.30	.007	.56	.83	.30

40 No Test made.

N½ SECTION 11, T-8-S, R-12-E.

MURMANILL EXPLORATION

*3.9 EL. = 1246

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %
A	75	19.3	14.5	35.9	521
B	66	30.5	20.1	47.3	931
C	61	35.2	21.5	52.3	1124
D	71	29.2	20.7	39.3	814
E	49	21.6	10.6	18.8	199
Avg	64	27.1	17.5	41.3	722

Fe Units NW ¼ 362

*2.8 EL. = 1289

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %
A	69	22.4	15.5	30.1	466
B	65	20.5	13.3	33.9	451
C	57	9.5	5.4	19.1	103
D	71	9.3	6.6	27.0	178
E	67	14.2	9.5	39.7	377
Avg	66	15.3	10.1	31.3	315

Fe Units NE ¼ 323

*2.9 EL. = 1315

MAGNETICS

	US %	US %	TOT %	Fe %	UNITS %	US H_2O %
A	57	24.0	13.7	29.8	408	2.1
B	69	16.6	11.5	30.0	345	2.1
C	76	26.4	20.1	35.5	714	1.1
D	58	19.7	11.4	33.1	377	1.7
E	54	10.8	5.8	25.3	147	1.7
Avg	63	19.9	12.5	31.9	398	1.7

*11.4 EL. = 1245

MAGNETICS

	US	US	TOT	Fe	UNITS	U.S. H_2O
A	71	7.2	5.1	30.3	155	2.3
B	67	9.1	6.1	32.4	198	1.8
C	72	8.3	6.0	16.7	100	3.0
D	78	8.7	6.7	30.5	204	3.5
E	70	9.7	6.8	35.0	238	2.5
Avg	72	8.6	6.2	29.1	179	2.6

*11.5 EL. = 1291

MAGNETICS

TiO_2		US	US	TOT	Fe	UNITS	US H_2O
237	A	67	31.6	21.2	28.1	595	2.3
235	B	54	12.7	6.9	18.4	127	3.8
244	C	50	11.8	5.9	25.1	148	3.1
172	D	48	11.1	5.3	19.7	104	5.2
119	E	49	22.8	11.2	17.6	197	4.5
205	Avg	54	18.1	10.1	23.2	234	3.7

*12.4 EL. = 1328

MAGNETICS

	US	US	TOT	Fe	UNITS	
A	45	18.4	8.3	17.0	141	3.7
B	52	17.5	9.1	30.7	279	2.7
C	58	18.4	10.7	32.6	349	3.5
D	67	19.1	12.8	39.2	502	2.2
E	64	18.2	11.6	38.8	450	1.8
Avg	57	18.4	10.5	32.8	344	2.7

DIRTY MAGNETIC CONCENTRATES

	Composite 11.4			Composite 11.5			Composite 12.4			Avg. Con. Sec. 11		
	Dirty Conc.	Mag Rej	U.S. Tot	Dirty Conc	Mag Rej.	U.S. Tot	Dirty Conc.	Mag. Rej.	U.S. Tot.	Dirty Conc.	Mag Rej.	U.S Tot
% Rec US	8.6	91.4	100.0	17.9	82.1	100.0	17.4	82.6	100.0	14.6	85.4	100.0
on Total	4.6	49.4	54.0	12.9	59.1	72.0	9.9	47.1	57.0	9.1	51.9	61.0
Fe	30.98	3.37	5.74	24.43	3.13	6.94	32.91	2.57	7.85	29.44	3.02	6.84
Ph	.254	—	—	.243	—	—	.194	—	—	.230	—	—
Mn	.21	—	—	.22	—	—	.22	—	—	.22	—	—
SiO_2	35.55	—	—	17.13	—	—	26.96	—	—	26.54	—	—
Al_2O_3	7.70	—	—	9.72	—	—	5.10	—	—	7.51	—	—
Sul	.004	—	—	.032	—	—	.005	—	—	.014	—	—
TiO_2	3.22	.95	1.14	2.46	1.20	1.43	3.00	1.21	1.52	2.89	1.12	1.36

N½ SEC. 11 — Fe Units 365; lbs/cu ft. 125; Mag Rec 3.47 %

Moisture 3.0 %; Caliche 0; Boulders 0

DIRTY CONCENTRATES

CONVERSION FACTOR

80 MESH GRIND				
	Clean Conc.	Tails	Slime	Total D.C.
	—	—	—	—
	38.1	37.7	24.2	100.0
	66.31	7.31	6.43	29.58
	.066	—	—	—
	.18	—	—	—
	1.11	—	—	—
	1.00	—	—	—
	.028	—	—	—
	1.42	5.13	1.73	2.89
CaO	1.14	—	—	—
MgO	.32	—	—	—

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 11, T8S, R12E, assayed as follows:

Gold - nil
Silver - less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Strontium	Gallium
Aluminum	Iron	Chromium	Lead
Silicon	Titanium	Potassium	Zirconium
Magnesium	Sodium		Nickel
			Silver
			Zinc
			Copper
			Molybdenum
			Barium

Geo Roseveare

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

SECTION #11

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	39.0	2.96	- -	115			21.3
U.S.	61.0	6.96	.80	425			78.7
Total Sands	100.0	5.40	- -	540			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of Whole				
O.S.Total	100.0	2.96	- -	39.0	115			
Magnetic	15.6	8.14	- -	6.1		49		9.1
Non-Mag	84.4	2.01	- -	32.9		66		12.2
Dry Mag.Heads	100.0	6.96	.80	61.0	425			
Non.Mag.Rej.	85.8	3.22	.45	52.3		168		31.1
D.C.Rec'y	14.2	29.58	2.89	8.7			257	47.6
Mill Heads	100.0	29.58	2.89	8.7	257			
Tails	37.7	7.31	5.13	3.3		25		4.6
Slime	24.2	6.43	1.73	2.1		13		2.4
80 Mesh Conc.	38.1	66.31	1.42	3.3			219	40.6

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Dirty Conc. Rec'y Fe	Dirty Conc. Rec'y TiO2	Non-Mag.Reject %	Non-Mag.Reject Fe	Non-Mag.Reject TiO2	Total 6 Mesh U. S. %	Total 6 Mesh U. S. Fe	Total 6 Mesh U. S. TiO2
On 8	6.5	5.13	1.04	5.9	1.61	.59	6.0	2.16	.66
10	16.5	6.97	1.42	12.0	1.77	.57	12.6	2.75	.73
14	15.1	11.22	2.20	12.1	2.09	.39	12.5	3.67	.70
20	11.8	20.84	3.94	10.8	3.05	.36	10.9	5.82	.92
40	25.3	59.23	4.90	18.4	3.39	1.15	19.5	13.85	1.85
80	19.0	54.02	3.68	17.7	4.35	2.29	17.9	11.[illegible]	2.50
100	2.3	57.63	2.17	4.3	4.36	1.67	4.0	8.30	1.71
200	2.3	50.58	1.96	9.2	4.19	.79	8.2	5.97	.84
-200	1.2	33.42	2.06	9.6	3.79	.46	8.4	4.37	.49
Total	100.0	33.78	3.15	100.0	3.22	.99	100.0	7.61	1.30

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe	Ph	Mn.	SiO2	Al2O3	Sul	TiO2	CaO	MgO
80 Mesh	38.1%	66.31	.066	.18	1.11	1.00	.028	1.42	1.14	.32
150 "	35.2%	67.27	.039	.16	.94	.92	.011	1.08	1.10	.27
40 "	46.8%	61.35	.195	- -	5.93	1.92	- -	3.30	- -	- -

SECTION 12, T-8-S, R-12-E.

MURMANILL EXPLORATION

\# 2.9 EL. = 1315

		MAGNETICS US	US	TOT	Fe	UNITS
		%	%	%	%	%
5	A	57	24.0	13.7	29.8	408
10	B	69	16.6	11.5	30.0	345
15	C	76	26.4	20.1	36.5	714
20	D	58	19.7	11.4	33.1	377
25	E	54	10.8	5.8	25.3	147
	Avg	63	19.9	12.5	31.9	398

Fe Units NW 1/4 312

\# 1.8 EL. = 1371

	MAGNETICS US	US	TOT	Fe	UNITS
	%	%	%	%	%
A	55	16.2	8.9	24.1	214
B	48	12.2	5.9	22.2	131
C	64	9.2	5.9	22.1	130
D	68	12.3	8.4	32.9	276
E	58	8.9	5.2	21.2	110
Avg	59	11.7	6.9	25.1	172

Fe Units NE 1/4 232

\# 1.9 EL. = 1416

	MAGNETICS US	US	TOT	Fe	UNITS	US H_2O
	%	%	%	%	%	%
A	61	11.3	6.9	21.3	147	2.5
B	54	12.8	6.9	27.5	190	2.5
C	64	11.5	7.4	36.6	271	0.8
D	60	7.1	4.3	29.2	126	0.6
E	50	10.7	5.3	21.7	115	1.2
Avg	58	10.6	6.2	27.5	170	1.5

\# 12.4 EL. = 1328

		MAGNETICS US	US	TOT	Fe	UNITS
5	A	45	18.4	8.3	17.0	141
10	B	52	17.5	9.1	30.7	279
15	C	58	18.4	10.7	32.6	349
20	D	67	19.1	12.8	39.2	502
25	E	64	18.2	11.6	38.8	450
	Avg	57	18.4	10.5	32.8	344

Fe Units SW 1/4 236

\# 12.5 EL. = 1358

TiO_2		MAGNETICS US	US	TOT	Fe	UNITS	US H_2O
3.82	A	66	8.0	5.2	26.9	140	0.9
3.13	B	76	10.1	7.7	32.9	253	1.1
3.23	C	64	13.1	8.4	36.1	303	0.6
3.15	D	70	15.4	10.8	38.1	411	1.0
3.50	E	58	26.0	15.1	36.9	557	1.5
3.35	Avg	67	14.1	9.4	35.3	333	1.0

Fe Units SE 1/4 206

\# 12.6 EL. = 1392

	MAGNETICS US	US	TOT	Fe	UNITS
A	68	8.8	6.0	28.4	170
B	71	22.4	15.9	43.0	684
C	44	15.1	6.6	19.0	125
D	51	19.0	9.7	15.6	151
E	58	12.9	7.5	19.6	147
Avg	58	15.7	9.1	28.0	255

\# 12.7 EL. = 1327 1329

		MAGNETICS US	US	TOT	Fe	UNITS	US H_2O
5	A	55	9.3	5.1	22.3	114	1.6
10	B	67	4.5	3.0	24.4	73	1.5
15	C	60	12.1	7.3	30.5	223	1.1
20	D	57	11.2	6.4	28.9	185	1.0
25	E	45	13.6	6.1	32.7	199	1.1
	Avg	57	9.8	5.6	28.5	159	1.3

\# 12.8 EL. = 1379

	MAGNETICS US	US	TOT	Fe	UNITS
A	59	8.3	4.9	13.4	66
B	62	8.3	5.1	16.8	86
C	63	13.1	8.3	24.7	205
D	54	6.8	9.7	18.9	70
E	57	9.2	5.2	23.7	123
Avg	59	9.2	5.4	20.1	110

\# 12.9 EL. = 1441

	MAGNETICS US	US	TOT	Fe	UNITS
A	48	11.9	5.7	16.2	92
B	56	10.5	5.9	16.4	97
C	67	8.4	5.6	18.3	102
D	64	9.8	6.3	24.1	152
E	61	11.4	7.0	28.8	202
Avg	59	10.3	6.1	21.1	129

DIRTY CONCENTRATES

DIRTY MAGNETIC CONCENTRATES

	Composite 1.9			Composite 12.5			Composite 12.7			Avg Sec. 12		
	Dirty Conc	Mag Rej.	U.S. Tot	Dirty Conc	Mag Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot	Dirty Conc.	Mag Rej.	U.S. Tot
% Rec. US	10.2	89.8	100.0	14.1	85.9	100.0	10.0	90.0	100.0	11.4	88.6	100.0
on Total	5.9	52.1	58.0	9.4	57.6	67.0	5.7	51.3	57.0	7.0	53.7	60.7
Fe	29.02	2.72	5.40	33.18	3.61	7.78	29.01	2.81	5.43	30.40	3.05	6.20
Ph	.297	—	—	.339	—	—	.276	—	—	.304	—	—
Mn	.28	—	—	.24	—	—	.22	—	—	.25	—	—
SiO_2	37.40	—	—	31.28	—	—	39.71	—	—	36.13	—	—
Al_2O_3	6.40	—	—	5.60	—	—	6.62	—	—	6.21	—	—
Sul	.004	—	—	.004	—	—	.004	—	—	.004	—	—
TiO_2	3.60	1.21	1.45	3.30	1.07	1.38	3.96	.52	.86	3.62	.93	1.23

CONVERSION FACTOR

80 MESH GRIND			
Clean Conc.	Tails	Slime	Total D.C.
—	—	—	—
41.1	42.9	16.0	100.0
66.62	11.40	9.15	33.74
.083	—	—	—
.16	—	—	—
2.57	—	—	—
.50	—	—	—
.007	—	—	—
1.40	5.00	2.52	3.12
1.25	—	—	—
.40	—	—	—

CaO
MgO

SEC. 12
Fe Units 230
lbs/cu.ft. 114
Mag. Rec 2.88

Moisture 1.3
Caliche 0
Boulders 0

O.A. SUNDNESS

SECTION #12

Distribution of Values

	Percentage Weight	Percentage Fe	Percentage TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	39.3	2.82	- - -	111			21.3
U.S.	60.7	6.73	.78	409			78.7
Total Sands	100.0	5.19	- -	520			100.0

	Percentage Fraction	Percentage Fe	Percentage TiO2	Weight % of Whole				
O. S. Total	100.0	2.82	- -	39.3	111			
Magnetic	11.8	8.27	- -	4.6		38		7.3
Non-Mag.	88.2	2.09	- -	34.7		73		14.0
Dry Mag.Heads	100.0	6.73	.78	60.7	409			
Non-Mag.Rej.	88.7	3.30	.48	53.8		177		34.1
D.C.Rec'y	11.3	33.74	3.12	6.9			232	44.6
Mill Heads	100.0	33.74	1.40	6.9	232			
Tails	42.9	11.40	5.00	3.0		35		6.7
Slime	16.0	9.15	2.52	1.1		10		1.9
80 Mesh Conc.	41.1	66.62	1.40	2.8			187	36.0

Sieve Test on Composite of 6 Mesh U. S.

	Dirty Conc. Rec'y %	Fe	TiO2	Non-Mag. Reject %	Fe	TiO2	Total 6 Mesh U. S. %	Fe	TiO2
On 8	6.7	5.86	1.30	7.2	1.61	.46	7.2	2.06	.55
10	14.9	7.62	1.42	16.1	1.61	.50	15.9	2.25	.60
14	13.7	13.16	3.14	15.2	1.85	.58	15.0	3.03	.85
20	12.0	23.68	5.38	13.4	2.09	.58	13.2	4.33	1.08
40	27.7	44.30	6.11	22.2	3.53	1.18	22.9	9.18	1.86
80	20.4	54.74	3.48	14.9	4.82	2.57	15.5	12.33	2.71
100	2.3	57.15	1.95	2.5	5.14	2.20	2.5	10.76	2.17
200	1.7	53.37	2.55	4.5	4.57	1.43	4.2	6.91	1.48
-200	.6	41.09	1.90	4.0	4.01	1.31	3.6	4.70	1.32
Total	100.0	32.08	3.88	100.0	2.93	1.10	100.0	6.27	1.41

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe	Ph	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO.	MgO
80 Mesh	41.1%	66.62	.083	.16	2.57	.50	.007	1.40	.97	.37
150 "	38.4%	68.06	.045	.17	1.42	1.10	.005	.80	1.02	.42

40 " No Test made.

UNIVERSITY OF ARIZONA
ARIZONA BUREAU OF MINES
ORE TESTING SERVICE

July 30, 1957

Mr. O. A. Sundness
Santa Rita Hotel
Tucson, Arizona

Composite sample Section 12, T8S, R12E assayed as follows:

Gold - nil
Silver - less than 0.05 oz. per ton

Spectrographic Analysis:

Strong	Medium	Weak	Trace
Calcium	Manganese	Strontium	Potassium
Aluminum	Iron		Lead
Silicon	Titanium		Gallium
Magnesium	Sodium		Chromium
			Silver
			Zinc
			Copper
			Molybdenum
			Barium

George Roseveare
Metallurgist

Above determinations were made on the rejects from a magnetic separation on minus 6-mesh undersize alluvial sand.

METALLURGICAL RESULTS OBTAINED ABOVE SHOULD BE CONSIDERED AS ONLY APPLICABLE TO MATERIAL CONFORMING TO THE CHARACTER OF THE SAMPLE UPON WHICH THE TESTS WERE MADE.

HOLES 'J'-'A'-'K' SECTIONS 8 & 17
T-8-S., R-12-E.

MURMANILL EXPLORATION

J EL = ?

MAGNETICS

		U.S.	U.S.	TOT.	Fe	UNITS	U.S. H_2O
		%	%	%	%	%	%
5	A	72	11.3	8.1	25.7	208	.3
10	B	68	14.8	10.1	25.7	260	.7
15	C	65	14.5	9.4	35.1	330	.7
20	D	66	19.1	12.6	20.4	257	.9
25	E	56	18.6	10.4	28.4	295	.7
30	F	74	17.0	12.6	31.1	392	.2
	AVG.	67	15.8	10.6	27.6	293	.6

1/4 MILE

K EL = ?

MAGNETICS

	U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
	%	%	%	%	%	%
A	79	9.0	7.1	41.7	296	.7
B	67	13.7	9.2	28.9	266	.8
C	70	12.8	9.0	26.5	240	.8
D	60	23.0	13.8	27.6	381	3.1
E	71	16.8	11.9	30.2	359	1.6
F	58	8.3	4.8	44.2	212	.9
AVG.	68	13.8	9.4	31.4	295	1.3

Hole "A" 300' SOUTH - 300' WEST OF Hole # K EL = ?

0' - 25'

MAGNETICS

	TiO_2		U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
			%	%	%	%	%	%
5	3.03	A	85	5.7	4.8	27.1	130	1.2
10	2.80	B	64	17.1	10.9	25.3	276	1.5
15	2.34	C	64	19.2	12.3	21.1	260	2.0
20	2.35	D	57	9.1	5.2	20.0	104	LOST
25	2.16	E	77	23.0	17.7	41.0	726	LOST
	2.56	AVG.	69	14.7	10.2	29.4	299	1.5

25' - 43'

MAGNETICS

	TiO_2		U.S.	U.S.	TOT	Fe	UNITS	U.S. H_2O
			%	%	%	%	%	%
30	3.00	F	56	16.5	9.2	41.8	403	.7
35	3.97	G	57	18.8	10.7	41.9	448	.6
40	3.95	H	77	21.1	16.2	50.7	821	.4
43	3.78	I	77	13.1	10.1	44.5	449	.7
	3.71	AVG.	67	17.3	11.6	45.9	530	.6

DIRTY MAGNETIC CONCENTRATES — DIRTY CONCENTRATES CONVERSION FACTOR

	COMPOSITE 25'-43'			80 MESH GRIND			
	DIRTY CONC.	MAG. REJ.	U.S. TOT.	CLEAN CONC.	TAILS	SLIME	TOTAL D.C.
%REC. U.S.	19.1	80.9	100.0	—	—	—	—
on TOTAL	12.8	54.2	67.0	64.4	23.6	12.0	100.0
Fe	49.69	3.37	12.22	67.65	18.84	14.27	49.73
Ph	.306	—	—	.093	—	—	—
Mn	.20	—	—	.16	—	—	—
SiO_2	18.10	—	—	1.75	—	—	—
Al_2O_3	6.00	—	—	.60	—	—	—
Sul.	.005	—	—	.005	—	—	—
TiO_2	3.26	.95	1.39	1.42	11.58	4.98	4.25
CaO				.56	—	—	—
MgO				.31	—	—	—

Fe Units 530 Moisture 0.6 %

lbs/cu.ft. 126 Caliche 0 %

Mag. Rec. 8.24 Boulders 0 %

HOLE "A"
(25 ft. - 43 ft.)

Distribution of Values

	Percentage Weight	Fe.	TiO2	Iron Units in Total Total	Lost	Rec'y	%
6 Mesh O.S.	33.0	2.07	- -	68			7.7
U.S.	67.0	12.20	2.07	818			92.3
Total Sands	100.0	8.86		886			100.0

	Percentage Fraction	Fe.	TiO2	Weight % of Whole				
O.S.Total	100.0	2.05	- -	33.0	68			
Magnetic	11.3	6.87	- -	3.7		25		2.8
Non-Mag.	88.7	1.44	- -	29.3		43		4.9
Dry Mag.Heads	100.0	12.20	2.07	67.0	818			
Non-MagRej.	80.9	3.37	1.55	54.2		182		20.7
D.C.Rec'y	19.1	49.73	4.25	12.8			636	71.6
Mill Heads	100.0	49.73	4.25	12.8	636			
Tails	23.6	18.84	11.58	3.0		56		6.3
Slime	12.0	14.27	4.98	1.5		20		2.2
80 Mesh Conc.	64,4	67.65	1.42	8.3			560	63.1

Sieve Test on Composite of 6 Mesh U. S.

On	Dirty Conc. Rec'y %	Fe.	TiO2	Non-Mag.Reject %	Fe.	TiO2	Total 6 Mesh U. S. %	Fe	TiO2
8	4.8	4.89	1.16	9.4	2.32	.70	8.6	2.58	.74
10	8.7	6.57	1.74	19.4	1.92	.92	17.5	2.34	.99
14	7.4	12.42	2.72	19.5	1.44	.67	17.4	2.28	.83
20	6.9	26.85	4.05	15.6	2.03	.61	14.0	4.22	.91
40	32.2	54.98	6.80	21.4	3.37	2.25	23.3	16.24	3.38
80	34.9	62.68	3.55	11.6	6.65	3.61	15.8	28.87	3.59
100	3.0	63.80	2.12	1.2	7.45	4.42	1.5	27.05	3.62
200	1.7	62.68	1.76	1.2	6.73	1.86	1.3	19.64	1.84
-200	.4	46.48	2.98	.7	4.57	.98	.6	17.06	1.18
Total	100.0	46.32	4.22	100.0	2.88	1.45	100.0	10.72	1.95

Conversion Factor Grinds Applicable to Dirty Concentrate.

	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O3	Sul.	TiO2	CaO	MgO
80 Mesh	64.4%	67.65	.093	.16	1.75	.60	.005	1.42	.56	.31
150 "	60.0%	68.13	.054	.14	1.76	1.26	.007	.42	.37	.56

W ½ OF SECTION 15, T-8-S. R-12-E.

MURMANILL EXPLORATION

HOLE "F" EL. = ?

		U.S. %	MAGNETICS U S %	TOT %	Fe %	UNITS %	U S H_2O %
5	A	75	16 3	12 2	24.5	299	1.1
10	B	65	17 6	11.4	23 7	270	2 0
15	C	66	15 5	10 2	36 2	369	.8
20	D	70	32 3	22 6	31.8	719	2.2
25	E	51	21 5	11.0	14.3	157	2.9
30	F	57	17.5	10.0	30.0	300	1.6
	AVG	64	20 2	12.9	27.3	352	1.7

O. A. SUNDNESS

COMPARISON SUMMARY OF VARIOUS FRACTIONS

Total Material

	6 Mesh Oversize	6 Mesh Undersize		Total
ec.1	44.7% @ 3.50 Fe.	55.3% @ 7.81 Fe.,	1.54 TiO2	100.0 @ 5.88% Fe.
2	39.7% @ 2.85 "	60.3% @ 7.26 "	1.09 "	100.0 @ 5.51 "
3	40.7% @ 3.00 "	59.3% @ 5.61 "	.94 "	100.0 @ 4.55 "
4	40.0% @ 3.34 "	60.0% @ 6.64 "	1.10 "	100.0 @ 5.32 "
5	39.3% @ 2.93 "	60.7% @ 5.53 "	.94 "	100.0 @ 4.51 "
8	43.0% @ 2.82 "	57.0% @ 6.47 "	.87 "	100.0 @ 4.90 "
9	42.7% @ 3.39 "	57.3% @ 6.53 "	.69 "	100.0 @ 5.19 "
10	43.0% @ 2.71 "	57.0% @ 5.80 "	.97 "	100.0 @ 4.47 "
11	39.0% @ 2.96 "	61.0% @ 6.96 "	.80 "	100.0 @ 5.40 "
12	39.3% @ 2.82 "	60.7% @ 6.73 "	.78 "	100.0 @ 5.19 "
ve.	41.1% @ 3.03 "	58.9% @ 6.53 "	.97 "	100.0 @ 5.09

6 Mesh Oversize

	Magnetic	Non-Magnetic.	Total
ec.1	17.1% @ 9.59 Fe.	82.9% @ 2.54 Fe.	100.0% @ 3.50% Fe.
2	11.0% @10.93 "	89.0% @ 1.85 "	100.0% @ 2.85% "
3	16.0% @ 9.12 "	84.0% @ 1.84 "	100.0% @ 3.00% "
4	24.0% @ 7.34 "	76.0% @ 2.08 "	100.0% @ 3.34% "
5	17.5% @ 5.44 "	82.5% @ 2.40 "	100.0% @ 2.93% "
8	14.4% @10.09 "	85.6% @ 1.60 "	100.0% @ 2.82% "
9	13.3% @ 8.80 "	86.7% @ 2.56 "	100.0% @ 3.39% "
10	12.3% @ 8.76 "	87.7% @ 1.86 "	100.0% @ 2.71% "
11	15.6% @ 8.14 "	84.4% @ 2.01 "	100.0% @ 2.96% "
12	11.8% @ 8.27 "	88.2% @ 2.09 "	100.0% @ 2.82% "
ve.	15.3% @ 8.64 "	84.7% @ 2.08 "	100.0% @ 3.03% "

15.3% x 41.1 (% O.S.) is 6.3% of Total Material.

6 Mesh Oversize Composite ground to 40 Mesh

	%	Fe	TiO2	% of Whole
Head Sample (40 Mesh)	100.0	2.87	.35	41.1
Rejected by Magnet	97.8	1.91	.30	40.2
Recovered by Magnet	2.2	45.60	2.54	.9

his Dirty Conc. ground to 80 Mesh

Wet Magnetic Recovery	63.4	64.41	1.46	.57
Tails	19.5	15.78	6.26	.18
Slimes	17.1	9.88	2.30	.15

6 Mesh Undersize.

Sec.	Magnetic %	Magnetic Fe.	Magnetic TiO2	Non-Magnetic %	Non-Magnetic Fe.	Non-Magnetic TiO2	Total %	Total Fe.	Total TiO2
1	16.2	30.85	4.01	83.8	3.36	1.06	100.0	7.81	1.54
2	15.3	30.59	2.61	84.7	3.05	.82	100.0	7.26	1.09
3	13.4	24.31	1.72	86.6	2.72	.82	100.0	5.61	.94
4	16.4	24.46	2.51	83.6	3.15	.75	100.0	6.64	1.10
5	12.7	23.83	1.70	87.3	2.87	.75	100.0	5.53	.94
8	13.3	28.79	1.95	86.7	3.05	.71	100.0	6.47	.87
9	13.7	29.39	2.44	86.3	2.90	.41	100.0	6.53	.69
10	11.2	26.21	2.14	88.8	3.23	.82	100.0	5.80	.97
11	14.2	29.58	2.89	85.8	3.22	.45	100.0	6.96	.80
12	11.3	33.74	3.12	88.7	3.30	.48	100.0	6.73	.78
Ave.	13.8	28.17	2.51	86.2	3.09	.71	100.0	6.53	.97

13.8% x 58.9 (% U.S.) is 8.13% of total material as dirty concentrate.

Recovery from 80 Mesh Grind on above Magnetics.

	Concentrate %	Concentrate Fe.	Concentrate TiO2	Tailings %	Tailings Fe	Tailings TiO2	Slimes %	Slimes Fe.	Slimes TiO2
1	38.0	65.54	1.70	40.1	10.55	7.20	21.9	7.83	2.20
2	38.3	66.79	1.15	41.0	8.52	4.37	20.7	7.31	1.81
3	31.4	64.74	1.77	43.6	5.83	.92	25.0	5.75	3.07
4	32.0	64.02	2.00	42.4	5.91	.70	25.6	5.75	1.16
5	28.0	66.35	1.40	43.6	7.68	2.17	28.4	6.72	1.27
8	38.2	65.48	1.56	34.8	6.25	2.87	27.0	5.93	1.33
9	36.7	65.79	1.01	38.6	8.48	4.10	24.7	8.00	2.00
10	32.7	65.13	1.34	38.5	7.83	3.25	28.8	6.62	1.56
11	38.1	66.31	1.42	37.7	7.31	5.13	24.2	6.48	1.73
12	41.1	66.62	1.40	42.9	11.40	5.00	16.0	9.15	2.52
Ave.	35.5	65.68	1.48	40.3	7.98	3.57	24.2	6.95	1.87

35.5 x 8.13 (% of total material) is 2.89% Recovery from Total.

Recovery from 150 Mesh Grind

	Concentrate %	Concentrate Fe.	Concentrate TiO2	Tailings %	Tailings Fe.	Tailings TiO2	Slimes %	Slimes Fe.	Slimes TiO2
1	37.5	66.98	1.05	29.2	11.67	6.70	33.3	8.79	3.32
2	37.3	68.24	.80	24.8	9.32	5.40	37.9	7.64	2.56
3	30.5	66.09	.76	36.3	6.71	1.54	33.2	7.02	3.54
4	30.6	66.57	1.05	22.4	8.62	7.22	47.0	6.07	2.61
5	28.0	66.35	1.40	43.6	7.68	2.17	28.4	6.72	1.27
8	37.5	67.65	.83	28.7	7.61	5.82	33.8	7.53	1.81
9	36.1	67.23	.79	35.3	8.16	4.18	28.6	7.04	2.67
10	31.0	67.31	.50	34.5	7.10	4.31	34.5	7.75	2.10
11	35.2	67.27	1.08	29.2	8.70	5.76	35.6	6.99	2.31
12	38.4	68.06	.80	38.9	10.59	6.10	22.7	10.35	3.50
Ave	34.2	67.18	.86	32.3	8.61	4.92	33.5	7.59	2.57

34.2 x 8.13(% of total material) is 2.78% Recovery from Total

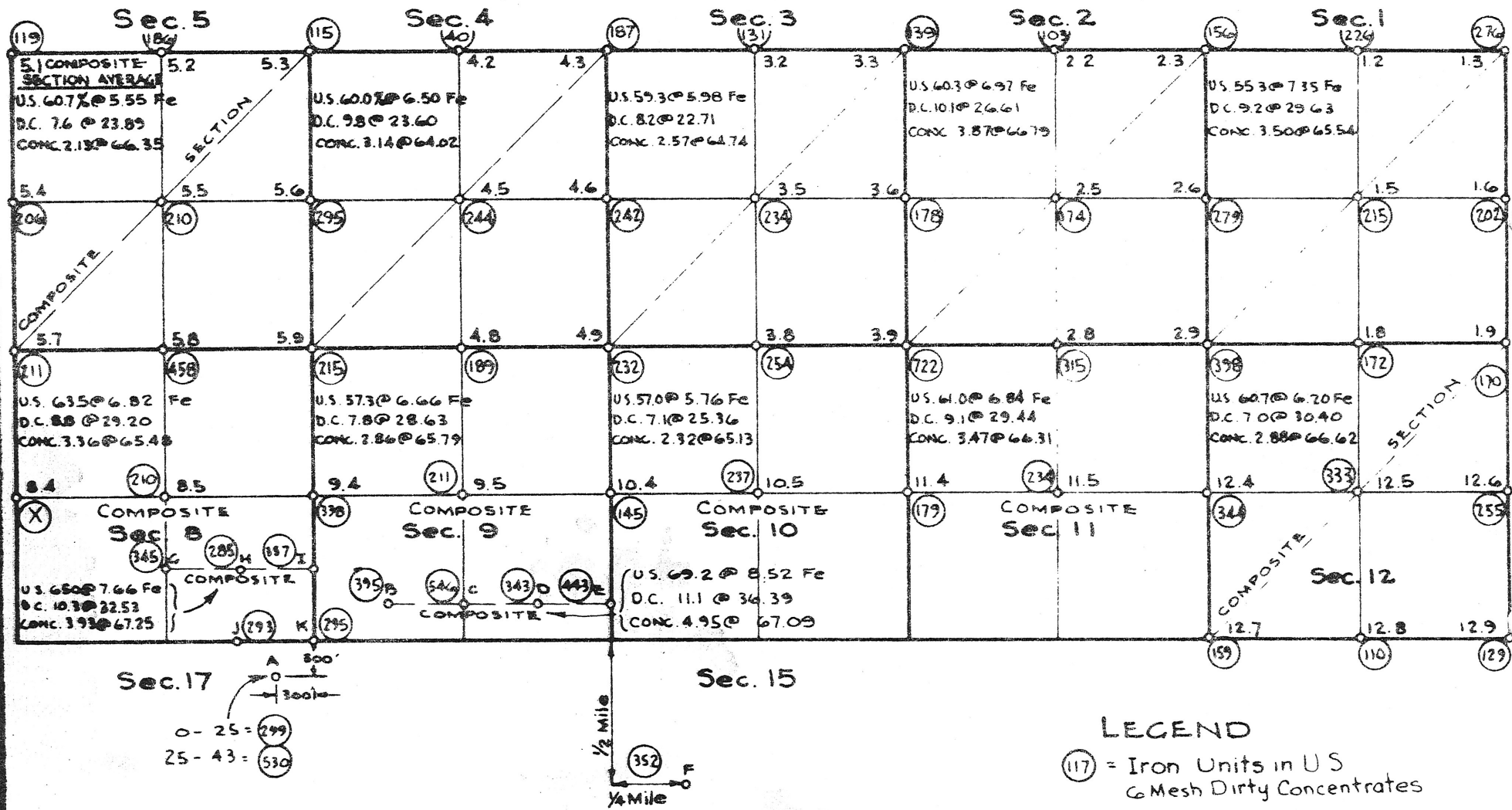
Recovery from 40 Mesh Grind

1	49.7	58.63	4.40	33.7	4.73	3.86	16.6	5.45	1.13
3	34.8	60.51	3.26	42.5	4.48	3.00	22.7	4.16	.66
5	37.7	61.47	3.78	37.7	4.16	3.50	24.6	5.68	.50
11	46.8	61.35	3.80	34.7	4.81	4.08	18.5	4.81	1.00
Ave	42.2	60.50	3.81	37.2	4.54	3.61	20.6	5.02	.85

42.2 x 8.13 (% of total material) is 3.43% Recovery from Total.

SECTIONS 1 TO 5 AND SECTIONS 8 TO 12
AND PORTION OF SECTIONS 15 & 17, T-8-S, R-12-E.

MURMANILL EXPLORATION



O. A. SUNDNESS

ANALYTICAL COMPARISON OF VARIOUS GRINDS

80 Mesh Grind

Sec.	Rec'y	Fe.	Ph.	Mn.	SiO2	Al2O6	Sul	TiO2	MgO	CaO
1	38.0%	65.54	.084	.18	3.65	1.16	.006	1.70	.97	.37
2	38.3	66.79	.072	.32	2.45	1.65	.006	1.15	1.10	.32
3	31.4	64.74	.076	.24	3.76	1.27	.006	1.77	1.56	.57
4	32.0	64.02	.060	.24	4.47	1.02	.006	2.00	1.73	.72
5	28.1	66.35	.063	.22	2.99	1.80	.006	1.40	2.23	.80
8	38.2	65.48	.078	.20	3.70	1.34	.008	1.56	.65	.23
9	36.7	65.79	.063	.20	2.99	1.05	.007	1.01	.80	.40
10	32.7	65.13	.075	.20	3.70	1.24	.007	1.34	1.00	.41
11	38.1	66.31	.066	.18	1.11	1.00	.028	1.42	1.14	.32
12	41.1	66.62	.083	.16	2.57	.50	.007	1.40	1.25	.40
ve.	35.5	65.68	.072	.21	3.14	1.20	.009	1.47	1.24	.45

150 Mesh Grind

1	37.5	66.98	.072	.22	2.75	1.00	.010	1.05	1.02	.42
2	37.3	68.24	.034	.16	1.75	1.00	.006	.80	.87	.30
3	30.5	66.09	.057	.22	3.56	1.40	.008	.76	1.36	.48
4	30.6	66.57	.048	.18	3.02	1.30	.006	1.05	1.22	.60
5	28.0	66.35	.047	.20	3.11	2.20	.008	.91	1.90	.61
8	37.5	67.65	.042	.20	2.66	1.52	.006	.83	.71	.25
9	36.1	67.23	.047	.18	3.63	1.04	.008	.79	.70	.30
10	31.0	67.31	.039	.16	2.36	1.80	.007	.50	.83	.30
11	35.2	67.27	.039	.16	.94	.92	.011	1.08	1.10	.27
12	38.4	68.06	.045	.17	1.42	1.10	.005	.80	.80	.31
ve.	34.2	67.18	.047	.18	2.52	1.33	.007	.86	1.05	.38

40 Mesh Grind

1	49.7	58.65	.243	-	5.88	1.65	-	4.40	-	-
3	34.8	60.51	.231	-	5.84	2.50	-	3.26	-	-
5	37.7	61.47	.204	-	4.58	2.82	-	3.78	-	-
1	46.8	61.35	.195	-	5.93	1.92	-	3.80	-	-
ve.	42.2	60.50	.218	-	5.56	2.22	-	3.81	-	-

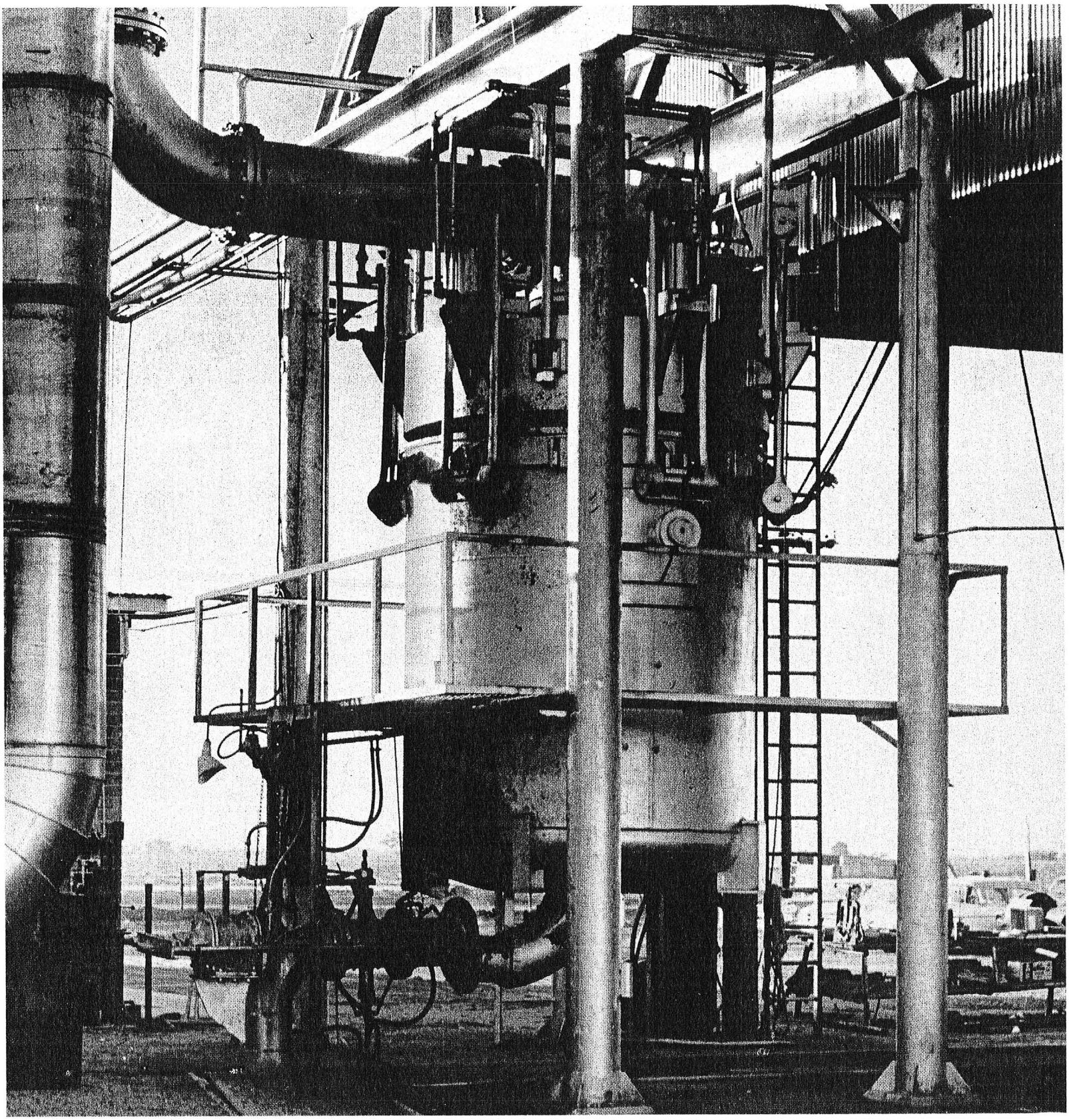
DISTRIBUTION AND RECOVERY OF IRON UNITS

Sec. Comp.	6 Mesh Undersize % of Whole	Iron Fe.	Iron Units	Dirty Concentrate % of Whole	Iron Fe.	Iron Units	Final Fe 304 Concentrate 80 Mesh Factor	% of Whole	Iron Fe.	Iron Units
#1	55.3	7.81	432	9.0	30.85	277	38.0	3.4	65.54	223
2	60.3	7.26	438	9.2	30.59	282	38.3	3.5	66.79	235
3	59.3	5.61	333	7.9	34.31	193	31.4	2.5	64.74	162
4	60.0	6.64	398	9.8	24.46	240	32.0	3.1	64.02	199
5	60.7	5.53	336	7.6	23.83	181	28.0	2.1	66.35	139
8	57.0	6.47	369	7.6	28.79	219	38.2	2.9	65.48	190
9	57.3	6.53	374	7.9	29.39	232	36.7	2.9	65.79	191
10	57.0	5.80	330	6.4	26.21	167	32.7	2.1	65.13	136
11	61.0	6.96	425	8.7	29.58	257	38.1	3.3	66.31	219
12	60.7	6.73	409	6.9	33.74	232	41.1	2.8	66.62	187
	58.9	6.53	384	8.1	28.17	228	35.5	2.9	65.68	190

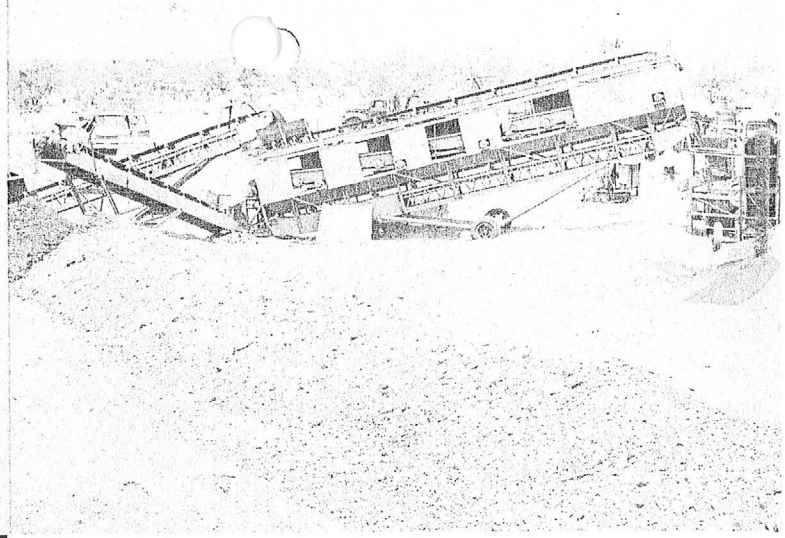
From above tabulation it will be noted that 228 Iron Units in the Dirty Concentrate resulted in a recovery of 2.9% by weight of the total sand @ 65.68% Fe., or 190 Iron Units. This is an 83.3% recovery of Iron Units from the Dirty Concentrates. If a 65.0% product is to be made, it follows that 78.0 Iron Units must be present in the Dirty Concentrate to provide 1 ton of clean product, or 351 Iron Units to provide 4½ tons of clean recoverable magnetite concentrate @ 65.0% Fe.

ARKOTA STEEL CORPORATION

NORTH ARIZONA BOULEVARD • COOLIDGE, ARIZONA

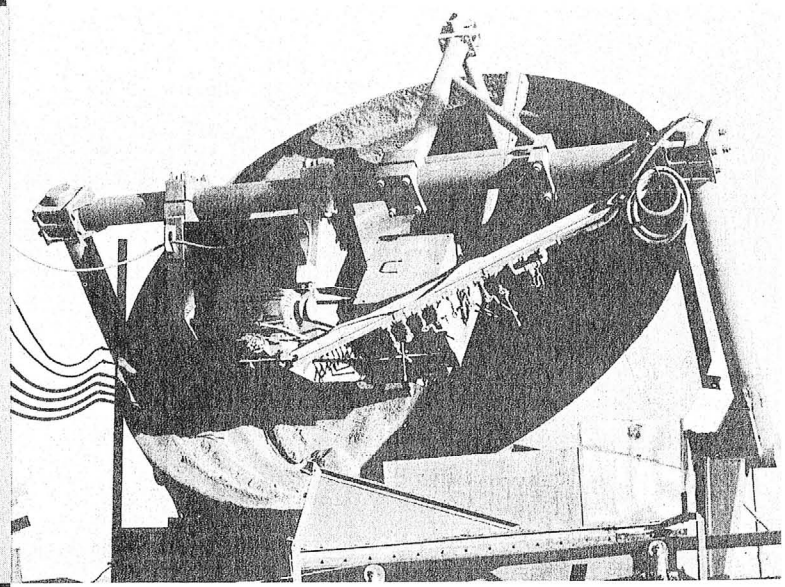


ARKOTA STEEL CORPORATION's new $1,500,000 plant at Coolidge, Arizona, 50 miles south of Phoenix, is the only commercial installation in the United States employing the renowned Madaras process to produce high-purity iron and steel for special applications. The process uses a controlled mixture of hydrogen and carbon monoxide gas to remove oxygen and sulfur from iron ore.



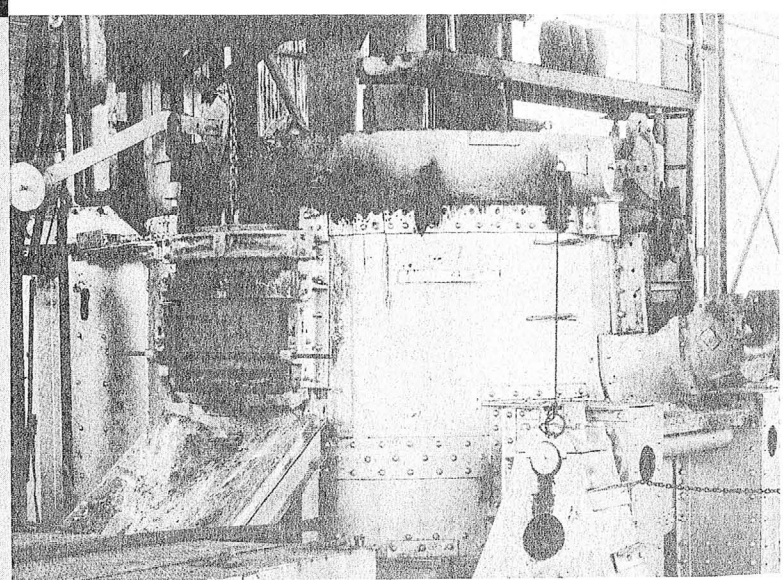
At the Arkota Mine 32 miles south of the Coolidge plant, crushers and magnetic separators process 7% magnetite ore to coarse "black sand" containing 62% Fe. Ore is trucked to Arkota plant.

ARKOTA's processing plant and its enormous reserves of magnetite (Fe_3O_4) at the Arkota Mine only 32 miles away combine to give Arizona its first ore-to-metal steel operation. Arkota's high grade metal products are much in demand by the chemical industry, ductile iron producers, and the superalloy and tool steel industries.

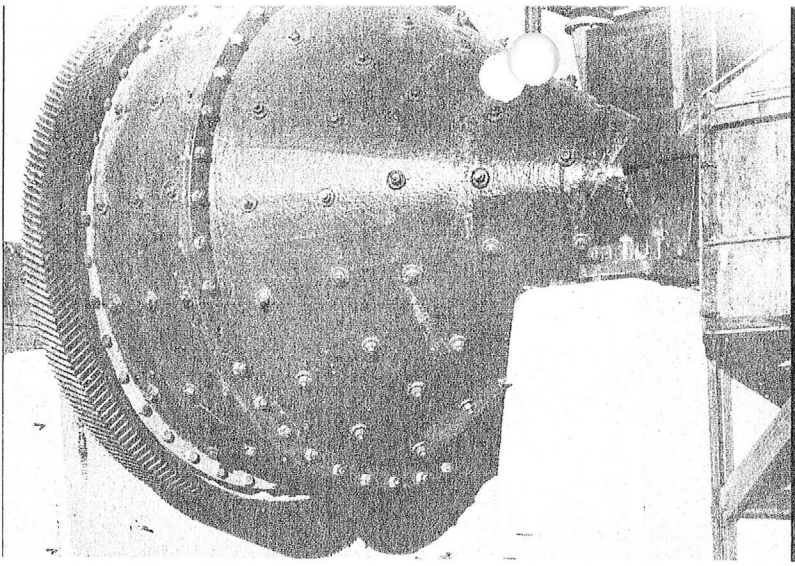


Ore charge then feeds to pelletizing unit above. Unreduced pellets of 70/71% Fe provide charge for Madaras process at Arkota. Arkota pellets may also be used as blast furnace charge.

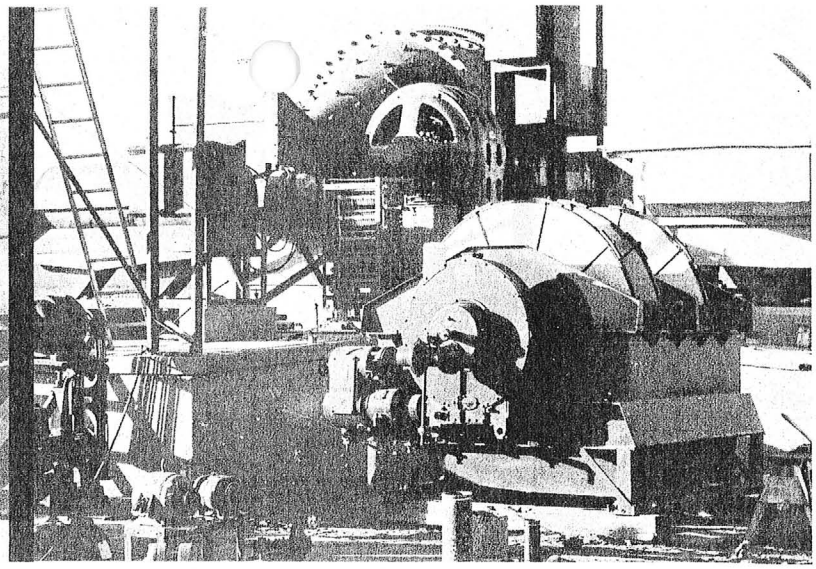
ARKOTA's products range upward from finely milled 71% Fe ore to 95/98% sponge iron briquettes, iron powder, iron pigs free of carbon, sulfur and phosphorus within 0.01% maximum, and ingots to specification. Present plant capacity of 25,000 tons of iron and steel annually will be increased, as additional equipment is added, to meet market requirements.



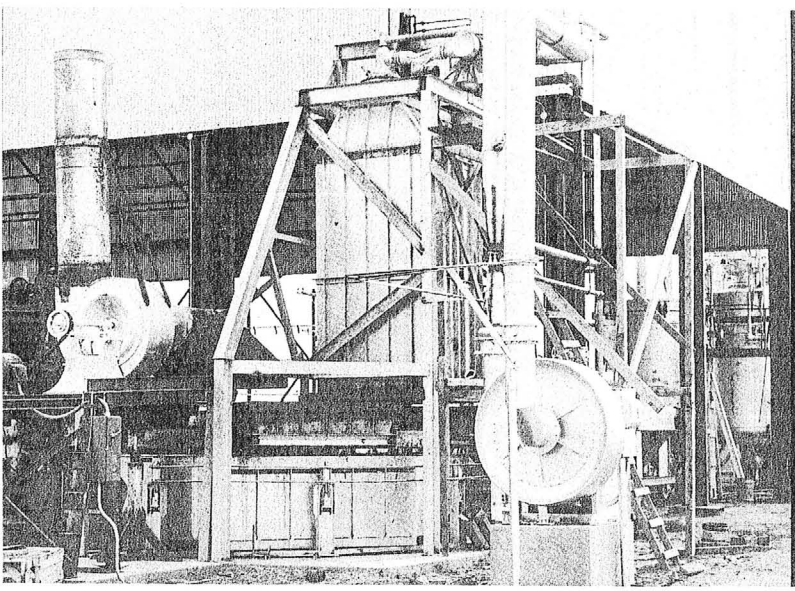
Sponge iron product is pressed into briquettes of 95% Fe, 0.01/6.0% C, 0.5% Si for ductile iron; 98% Fe briquettes for melting stock. Electric arc furnace above is next step in making Arkota 111.



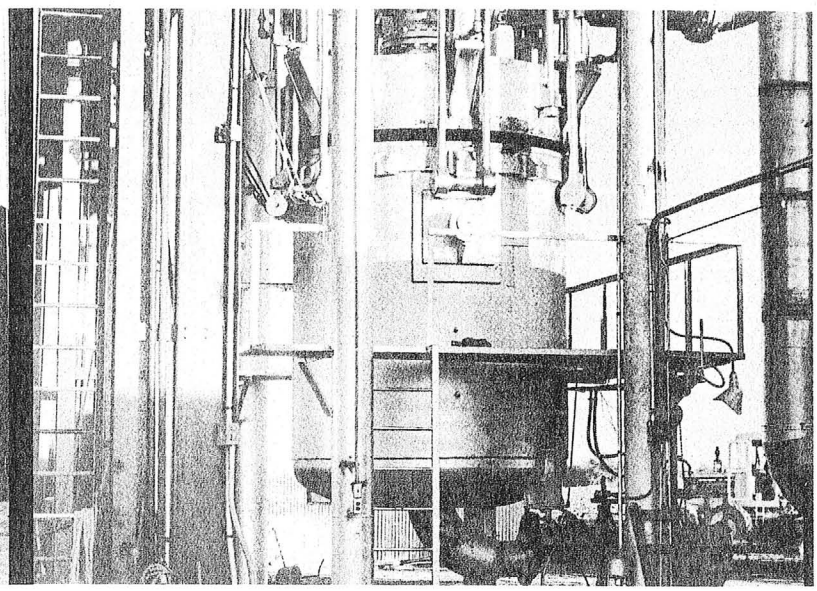
First stage of plant processing requires further removal of impurities, such as apatite, bound mechanically to metallic iron in "black sand." This begins when ore is charged by conveyor to ball grinding mill above.



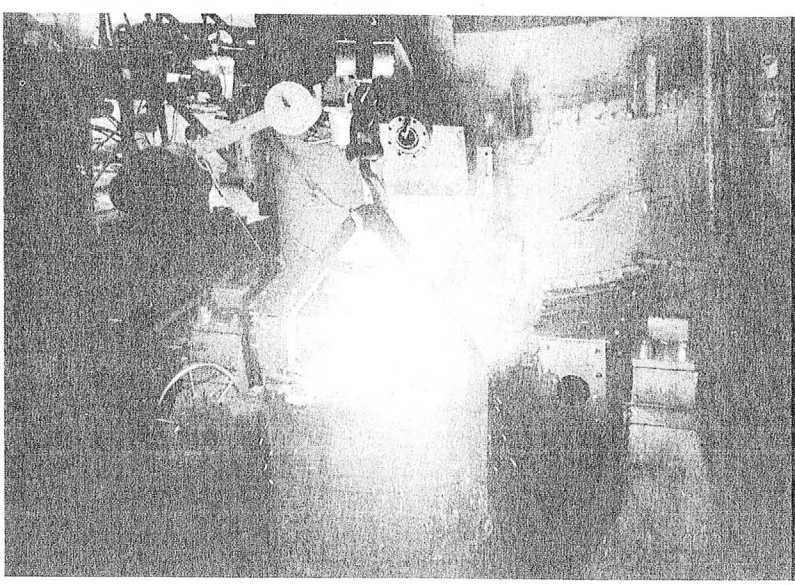
Further processing to refine ore continues with its passage through magnetic separator, settling tank, second separator, and filter. Ore product is then 200-mesh powder of commercially pure 70% Fe.



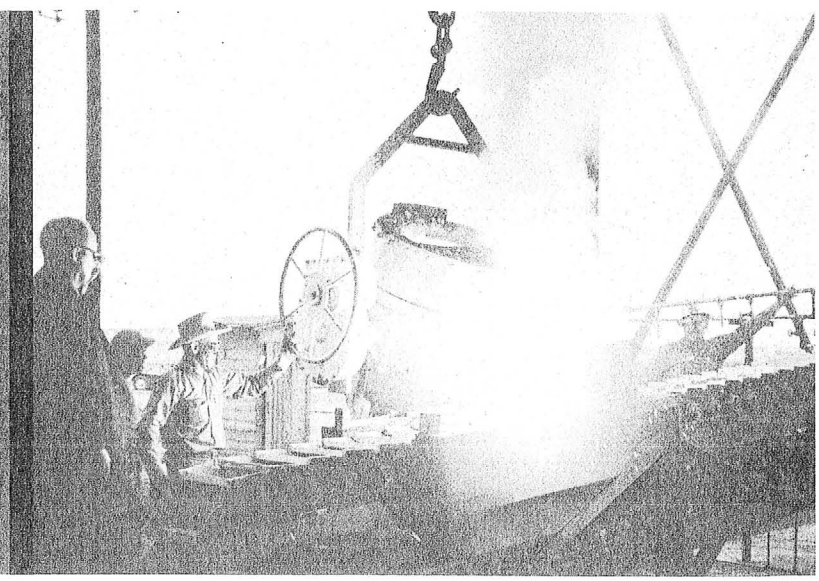
Pellets move by conveyor to heater-dryer above for processing to required hardness and temperature. Charge of 15/18 tons is loaded from rotating heater boxes to charge hoppers in pit for transfer to retort.



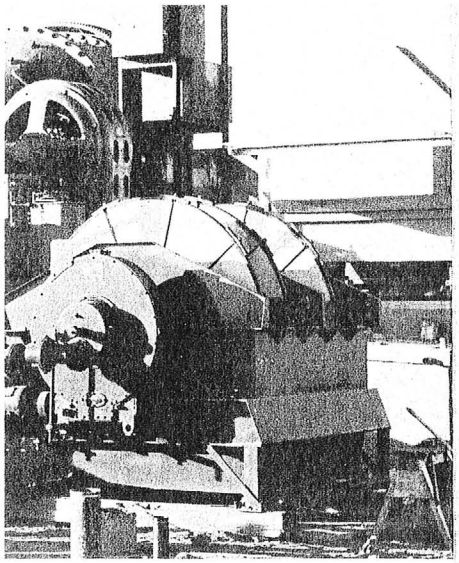
Catalytic and thermal reforming of natural gas create hydrogen-carbon monoxide mix. This passes downward through pellets in retort above, controlled by pulsating valve. Product is sponge iron, 95/100% reduced.



Electric furnace purifies Arkota sponge iron to highest degree of purity commercially available. Photo shows a typical "heat" being poured from furnace into ladle suspended from overhead traveling crane.



Final processing step is ladling molten metal at pig-casting unit above. Arkota 111, in pigs up to 50 lbs., is 99.8% Fe, with 0.01% maximum of carbon, sulfur, phosphorus — a degree of purity now attractively priced.



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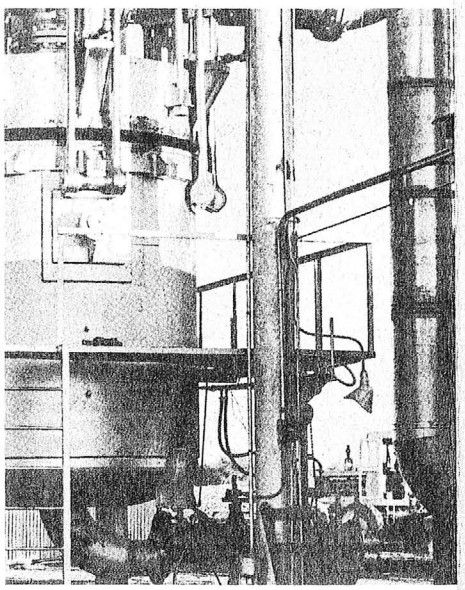

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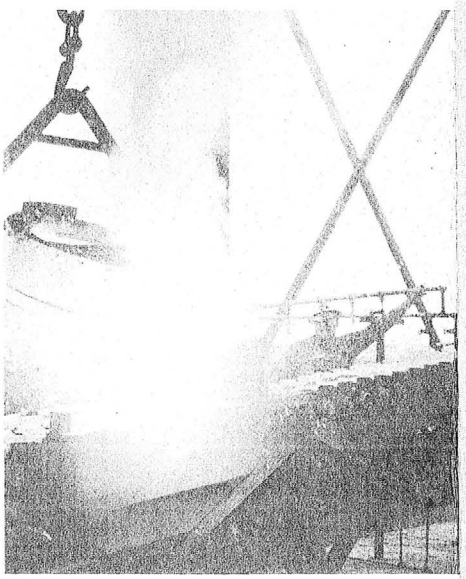

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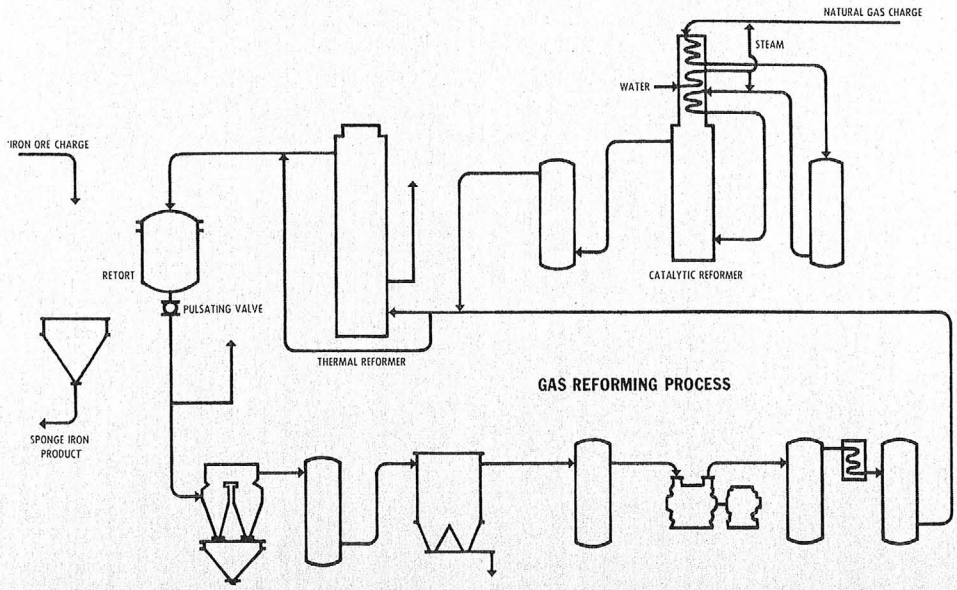

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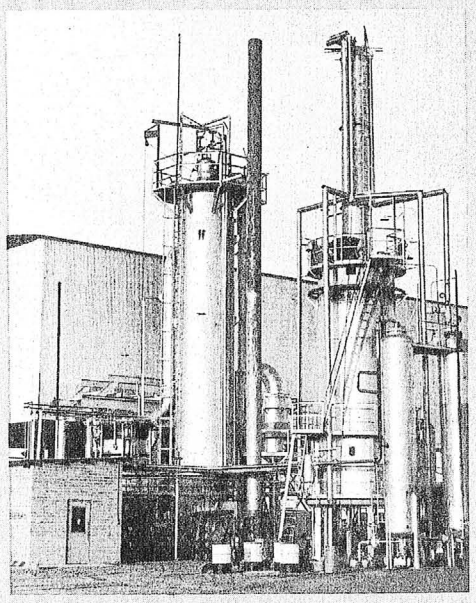
The process uses only natural gas and electric power, thus eliminating the need for coke in making iron.

Arkota is the first commercial-scale plant in the United States to employ this highly efficient, economical, semi-continuous process to remove oxygen and sulfur from iron ore by means of a controlled mixture of hot hydrogen and carbon monoxide gases.

The process and equipment were invented, perfected and patented by Julius D. Madaras, an Arkota vice president, for whom the process is named.

As shown in the simplified flow diagram above, pre-heated natural gas is desulfurized, mixed with steam, and reformed in the presence of a nickel-alumina catalyst. After quenching, the partially reformed gas is mixed with unreacted recirculating process gas. The mixture is then thermally reformed by a patented process in specially designed equipment to produce the desired mixture of hydrogen and carbon monoxide.



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Virtually complete reduction of the ore charge is accomplished in the retort, and the 95%-plus sponge iron is then processed into powder, briquettes, pigs or ingots as desired.

ARKOTA PRODUCTS AND THEIR APPLICATIONS

The distinguishing characteristic of Arkota Steel Corporation's varied line of basic products is their extreme accuracy in meeting exacting purity specifications required by manufacturers of highly critical components with specialized functions in defense and normal industry.

Producers of steels such as 52100 bearing, 17-4 PH stainless, and superalloys used by the aviation, rocket, missile, electronic and other industries, require base melting stocks with the greatest possible freedom from impurities in order to reduce their processing costs. Other industries require base stocks of varying material balance for uses ranging from pure iron powder for the chemical profession, to higher carbon content for ductile iron products and blast furnace burden.

Arkota 111 improved commercially pure iron pigs are produced in weights up to 50 lbs. for special steel and superalloy melting. In Arkota 111, carbon, sulfur and phosphorus are held to a maximum of 0.01%. Other impurities such as silicon, manganese, nitrogen, hydrogen and oxygen are completely eliminated or reduced to minute trace amounts. 99.8% Fe purity may be obtained.

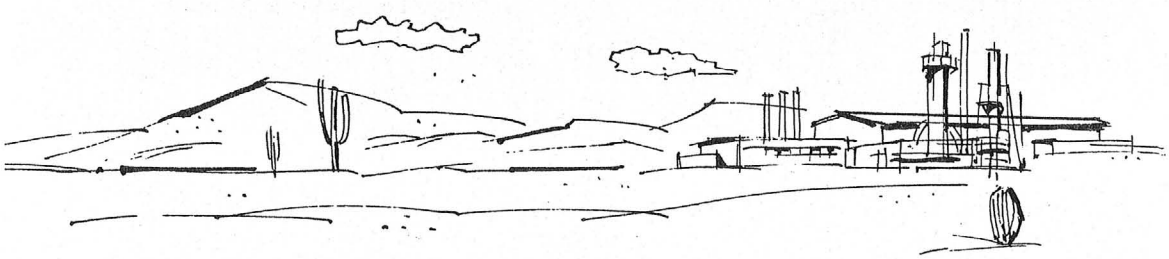
Arkota RSPO reduced sponge iron powder of 99%-plus Fe purity will be available in drums for the chemical industry and pressed or sintered products.

Arkota SBD sponge iron briquettes of 95%-plus Fe, 3.5% Carbon and 0.5% Si are produced for ductile iron melting. Shipment is by bulk or carton.

Arkota SBS reduced sponge iron briquettes for electric furnace melting of tool and specialty steels are guaranteed to have an Fe purity of 97%-plus with minimum amounts of carbon, sulfur, phosphorus and other undesirable elements. In drums.

Also available are unreduced ore and hard iron ore pellets containing 70%-71% iron, and magnetically separated coarse iron ore of 62%-66% Fe content, for use in sintering or smelting operations, roofing materials and other applications. These Arkota products are available in bulk only.

Producers of magnetic steels with low hysteresis loss and type 304 stainless for high corrosion resistance, ductile iron producers seeking desired nodular structure without expensive magnesium processing, and other users of ultra-clean high quality steels will find Arkota's products answering their goal of superior quality at reduced cost.



ARKOTA OFFICERS, DIRECTORS AND CONSULTANTS

PATRICK H. FEENEY, of Pierre, S.D., is Chairman of the Board of Directors and President of Arkota Steel Corporation. He has interests in ranching, real estate, motels and bowling enterprises, and is President of the Sodrac Race Track, North Sioux City, S. Dakota.

MARNEL LINDEKUGEL, of Mitchell, S.D., is Executive Vice President, Secretary, and a Director of Arkota Steel; Sec.-Treas. of the Missouri Basin Construction Co., Inc.; past president of the Associated General Contractors of South Dakota; director, Sodrac and Park Jefferson Tracks.

JULIUS D. MADARAS, Vice President of Arkota, is the inventor of the Madaras ore reduction process for making iron and steel. He lives in Coolidge, Arizona. He has been associated with the Ford Motor Co.; Allied Engineers; the Brazilian Government; Southwestern Metals, and Madiron, Inc.

DONALD J. MAHONEY, Arkota's Treasurer, is President of the Chamber of Commerce and the Industrial Development Corporation of Coolidge, Ariz., where he is active in real estate and insurance. His degree of Bachelor of Science in Business Administration is from the University of Arizona.

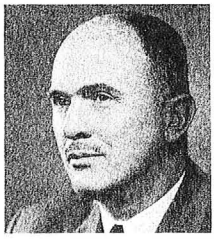
JOHN L. HEALY, a member of Arkota Steel's Board of Directors, resides in Sioux Falls, S. D., where he is President of J. L. Healy Construction Co. and Kolman Manufacturing Co.

SID BLAIR, a member of Arkota's Board of Directors, lives in Scottsdale, Arizona. Former President of the Pawhuska Milling Corp. Rancher in S. Dakota, Okla., Wyoming.

GEORGE E. SERCL, an Arkota director, divides his time between Phoenix and his home in Sioux Falls, S. D. He is a bank director and President of the Sunshine supermarket chain.

JESSE J. BAUM, Consultant to Arkota, is with a Frank Mayer Engineering Co. (Los Angeles) steel foundry team in Manila for ICA. He has been with Ingersoll Steel, Duraloy, Natl. Tube.

GERALD J. GROTT, Consultant to Arkota, is Operations and Asst. Gen. Mgr., WaiMet Alloys Co. (Div. Howe Sound), and was formerly Technical Director, Michigan-Standard Alloys Co.



ROGER F. WAINDLE, Consultant to Arkota, is President, WaiMet Alloys Co. (Div. Howe Sound), Dearborn, Mich.; a director, Investment Casting Inst.; former pres., Am. Soc. Tool & Mfg. Eng.

DEVELOPMENT OF THE MADARAS PROCESS

Julius D. Madaras conceived his process for reducing iron ore in 1936 while in Brazil, a country which – like others in South America and elsewhere – lacks coking coal for making steel. The process permits construction of steel plants near ore deposits where natural gas is available.

Born in Hungary in 1894 and educated as an engineer in Paris, Zurich and Berlin, Madaras came to the United States after World War I and continued his studies at Michigan and Michigan State Universities.

He was instrumental in simplifying assembly and production line problems for the Ford Motor Company, and worked on new power generating techniques for electric and gas utility groups.

While in Brazil studying that country's power problems at government invitation, Madaras began work on his method of reducing iron ore by means of hydrogen and carbon monoxide gas. Upon his return to the United States, he devoted himself to perfecting the process.

Laboratory tests at the University of Michigan demonstrated the feasibility and efficiency of the process, and in 1938 a Madaras process pilot unit was operated successfully at Peoria, Ill.

Two years later, during World War II, a larger unit was erected at Longview, Texas, where extensive successful tests were conducted and new equipment developed.

In the years from 1944 to 1953, Madaras developed additional special equipment and continued demonstrating his process to the steel industry. In this period, he was aided by Dr. Arthur H. Compton, noted U. S. scientist, and had the assistance of syndicate financing. A license to use the process commercially was granted in 1953 to a Mexican firm.

The Arkota plant at Coolidge is the first to use the Madaras reduction process commercially in the United States. This plant makes use of more advanced equipment and process techniques invented and developed by Madaras since 1953.

Arkota Steel Corporation is the exclusive licensee for the Madaras process in Arizona, and also holds non-exclusive licenses for Washington, Oregon, California and Nevada.

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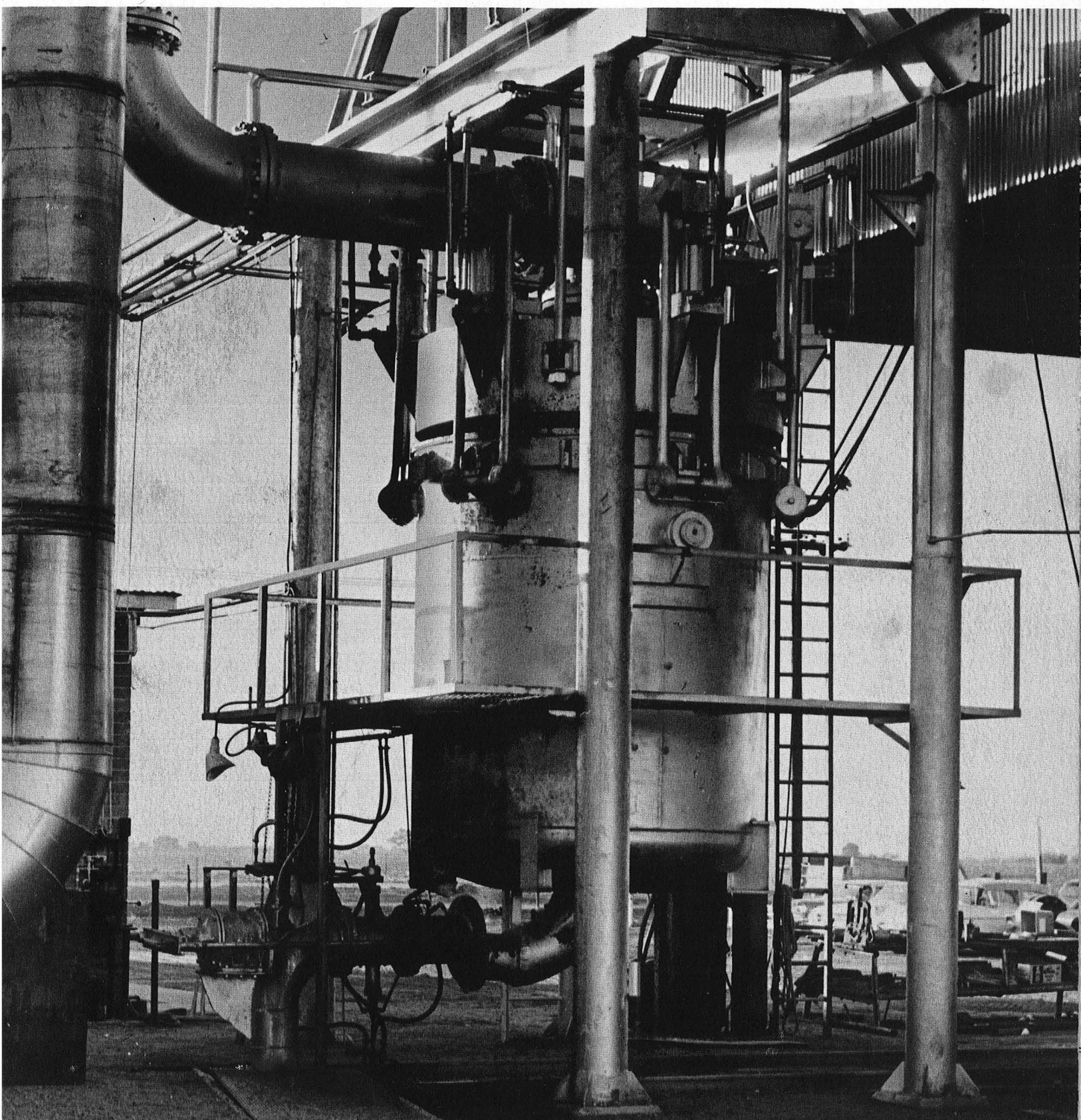
ARKOTA STEEL CORPORATION

NORTH ARIZONA BOULEVARD • COOLIDGE, ARIZONA



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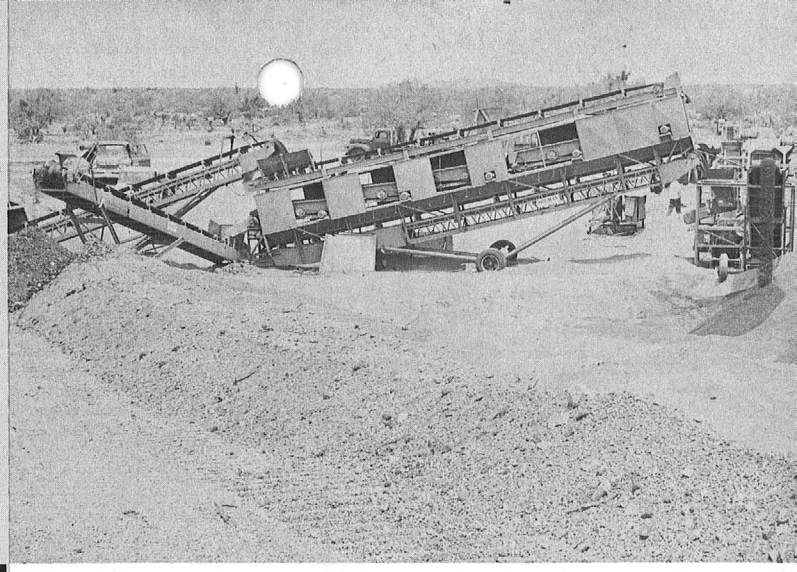

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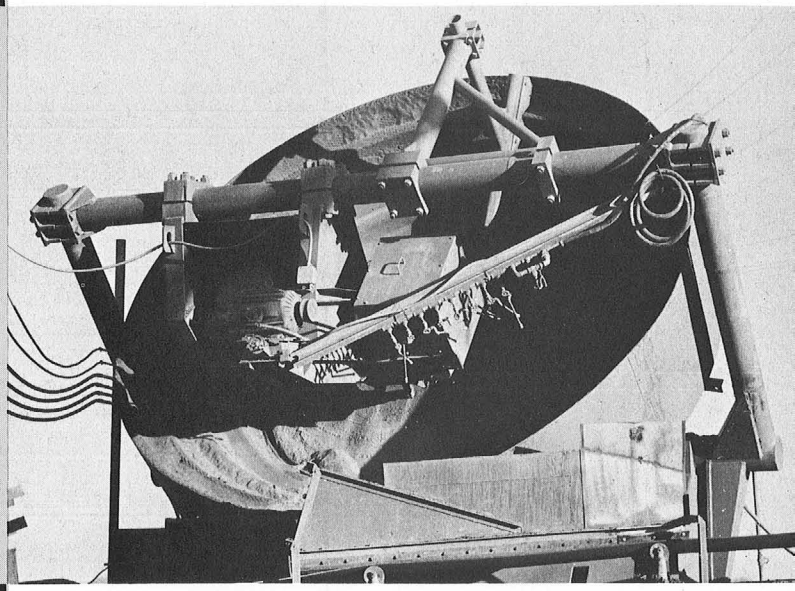

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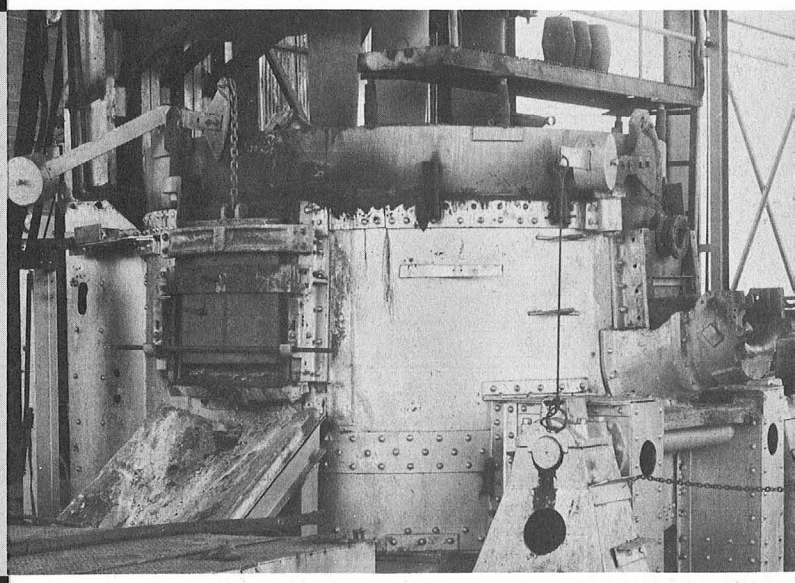

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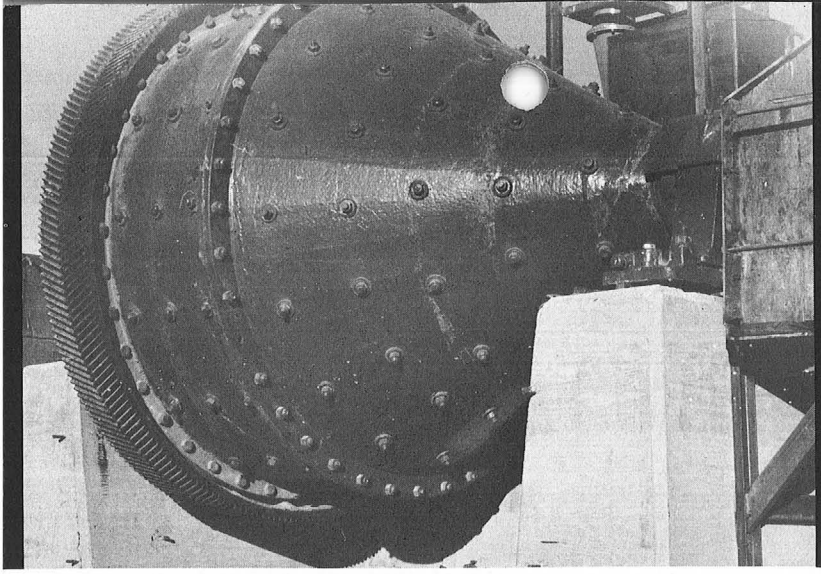

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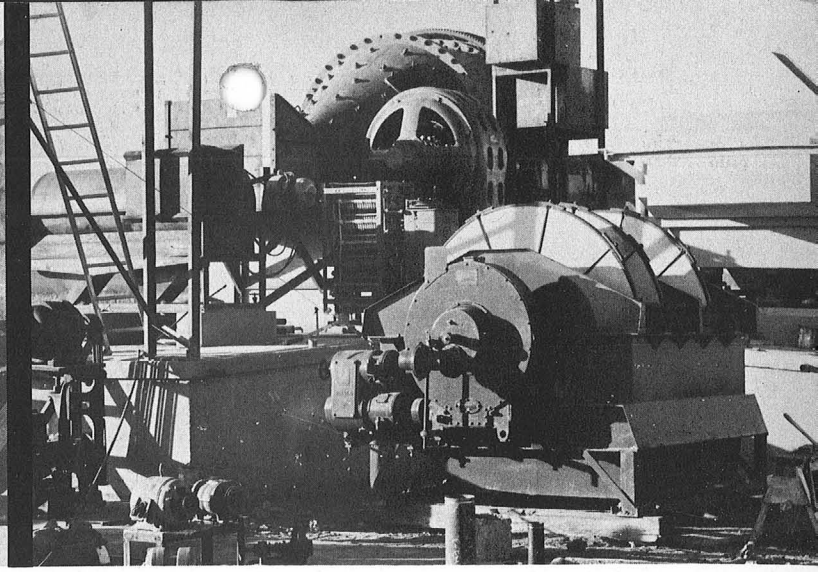

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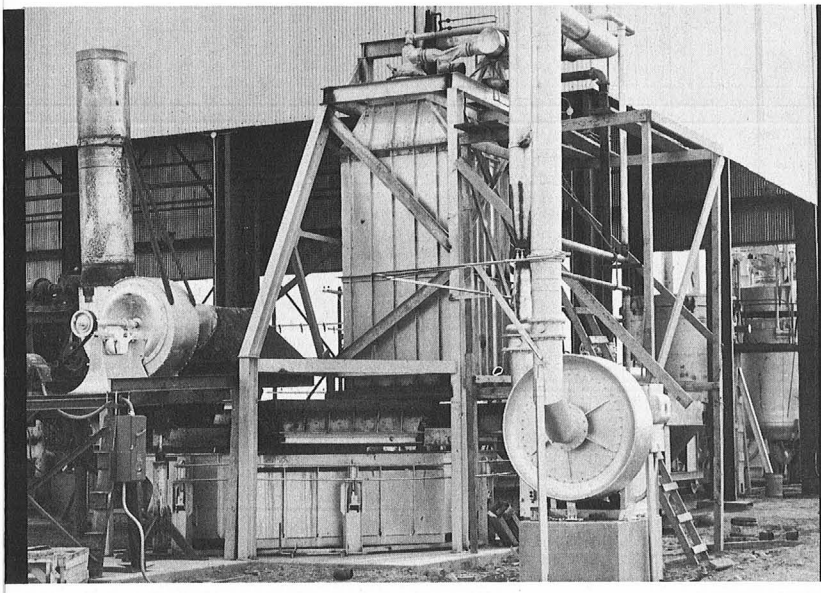

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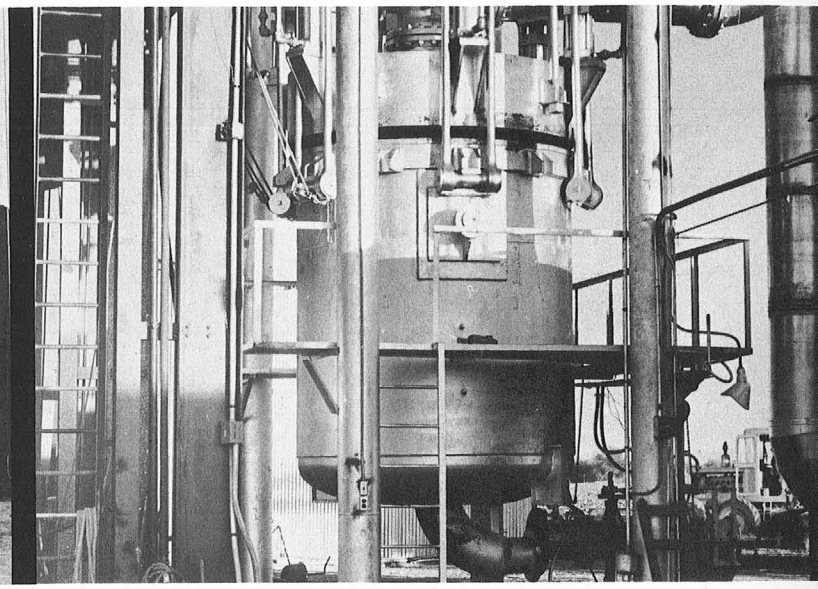

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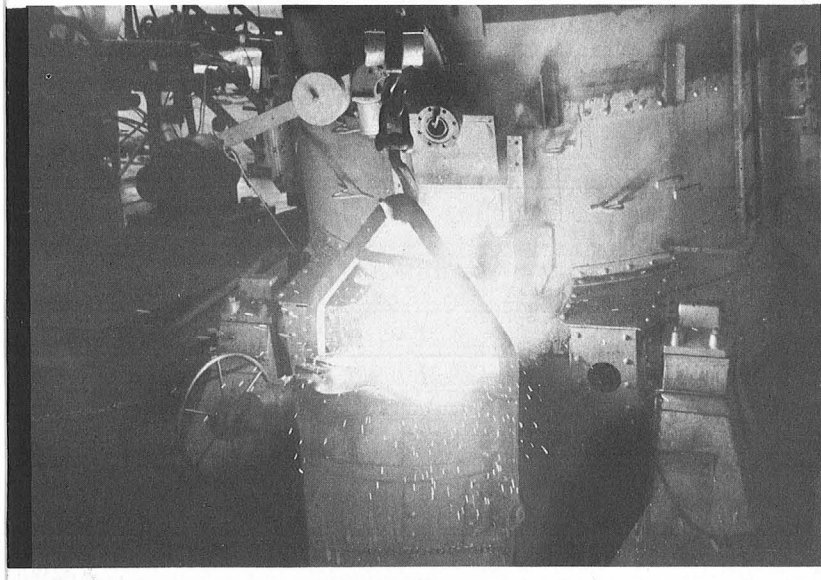

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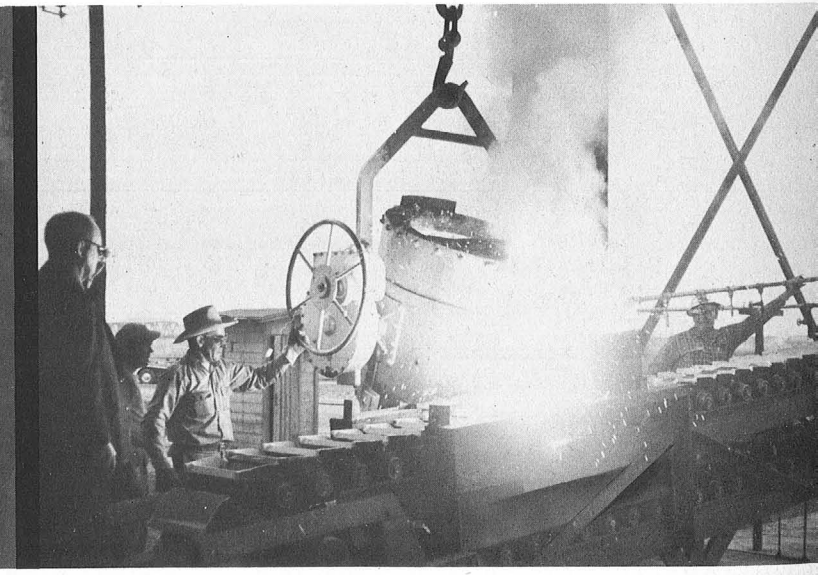

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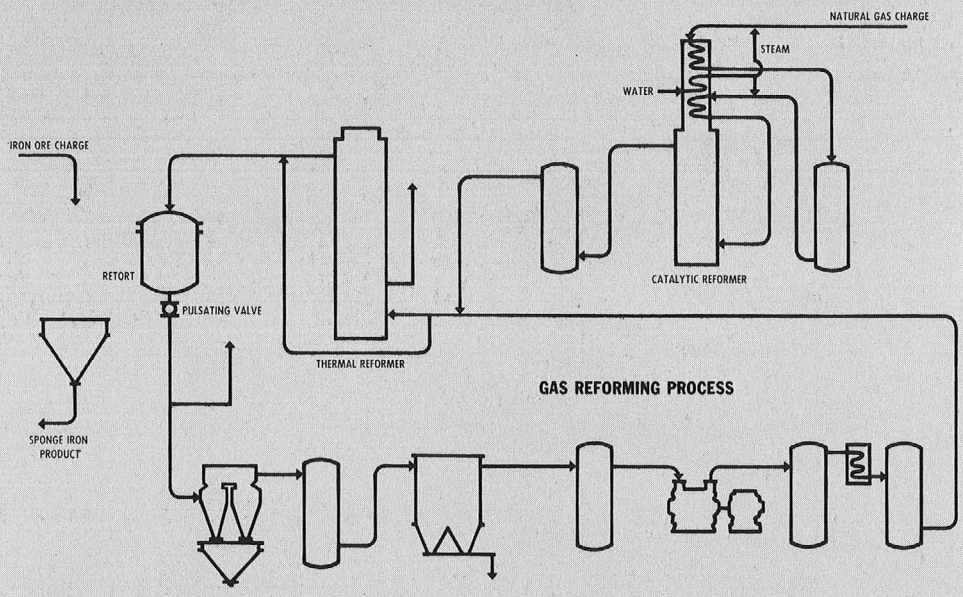
HOW ARKOTA REDUCES IRON ORE USING HYDROGEN FROM NATURAL GAS



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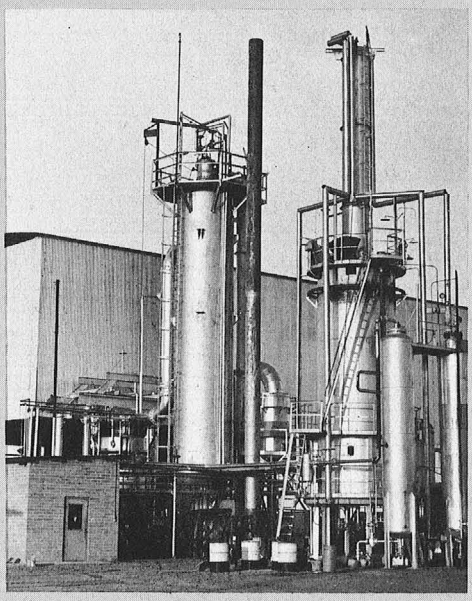

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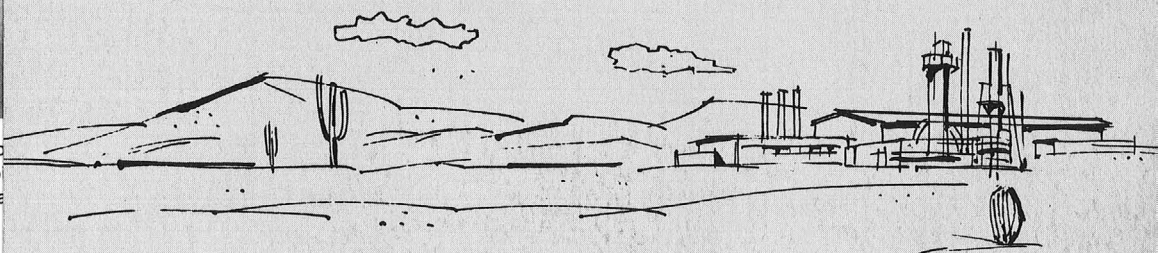
Arkota RSPO reduced sponge iron powder of 99%-plus Fe purity will be available in drums for the chemical industry and pressed or sintered products.

Arkota SBD sponge iron briquettes of 95%-plus Fe, 3.5% Carbon and 0.5% Si are produced for ductile iron melting. Shipment is by bulk or carton.

Arkota SBS reduced sponge iron briquettes for electric furnace melting of tool and specialty steels are guaranteed to have an Fe purity of 97%-plus with minimum amounts of carbon, sulfur, phosphorus and other undesirable elements. In drums.

Also available are unreduced ore and hard iron ore pellets containing 70%-71% iron, and magnetically separated coarse iron ore of 62%-66% Fe content, for use in sintering or smelting operations, roofing materials and other applications. These Arkota products are available in bulk only.

Producers of magnetic steels with low hysteresis loss and type 304 stainless for high corrosion resistance, ductile iron producers seeking desired nodular structure without expensive magnesium processing, and other users of ultra-clean high quality steels will find Arkota's products answering their goal of superior quality at reduced cost.

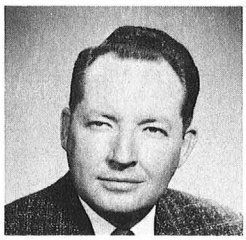


ARKOTA OFFICERS, DIRECTORS AND CONSULTANTS

PATRICK H. FEENEY, of Pierre, S.D., is Chairman of the Board of Directors and President of Arkota Steel Corporation. He has interests in ranching, real estate, motels and bowling enterprises, and is President of the Sodrac Race Track, North Sioux City, S. Dakota.

MARNEL LINDEKUGEL, of Mitchell, S.D., is Executive Vice President, Secretary, and a Director of Arkota Steel; Sec.-Treas. of the Missouri Basin Construction Co., Inc.; past president of the Associated General Contractors of South Dakota; director, Sodrac and Park Jefferson Tracks.

JULIUS D. MADARAS, Vice President of Arkota, is the inventor of the Madaras ore reduction process for making iron and steel. He lives in Coolidge, Arizona. He has been associated with the Ford Motor Co.; Allied Engineers; the Brazilian Government; Southwestern Metals, and Madiron, Inc.



DONALD J. MAHONEY, Arkota's Treasurer, is President of the Chamber of Commerce and the Industrial Development Corporation of Coolidge, Ariz., where he is active in real estate and insurance. His degree of Bachelor of Science in Business Administration is from the University of Arizona.

JOHN L. HEALY, a member of Arkota Steel's Board of Directors, resides in Sioux Falls, S. D., where he is President of J. L. Healy Construction Co. and Kolman Manufacturing Co.

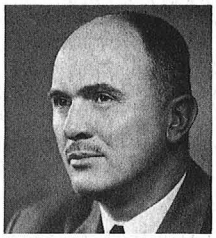
SID BLAIR, a member of Arkota's Board of Directors, lives in Scottsdale, Arizona. Former President of the Pawhuska Milling Corp. Rancher in S. Dakota, Okla., Wyoming.

GEORGE E. SERCL, an Arkota director, divides his time between Phoenix and his home in Sioux Falls, S. D. He is a bank director and President of the Sunshine supermarket chain.

JESSE J. BAUM, Consultant to Arkota, is with a Frank Mayer Engineering Co. (Los Angeles) steel foundry team in Manila for ICA. He has been with Ingersoll Steel, Duraloy, Natl. Tube.

GERALD J. GROTT, Consultant to Arkota, is Operations and Asst. Gen. Mgr., WaiMet Alloys Co. (Div. Howe Sound), and was formerly Technical Director, Michigan-Standard Alloys Co.

ROGER F. WAINDLE, Consultant to Arkota, is President, WaiMet Alloys Co. (Div. Howe Sound), Dearborn, Mich.; a director, Investment Casting Inst.; former pres., Am. Soc. Tool & Mfg. Eng.



DEVELOPMENT OF THE MADARAS PROCESS

Julius D. Madaras conceived his process for reducing iron ore in 1936 while in Brazil, a country which – like others in South America and elsewhere – lacks coking coal for making steel. The process permits construction of steel plants near ore deposits where natural gas is available.

Born in Hungary in 1894 and educated as an engineer in Paris, Zurich and Berlin, Madaras came to the United States after World War I and continued his studies at Michigan and Michigan State Universities.

He was instrumental in simplifying assembly and production line problems for the Ford Motor Company, and worked on new power generating techniques for electric and gas utility groups.

While in Brazil studying that country's power problems at government invitation, Madaras began work on his method of reducing iron ore by means of hydrogen and carbon monoxide gas. Upon his return to the United States, he devoted himself to perfecting the process.

Laboratory tests at the University of Michigan demonstrated the feasibility and efficiency of the process, and in 1938 a Madaras process pilot unit was operated successfully at Peoria, Ill.

Two years later, during World War II, a larger unit was erected at Longview, Texas, where extensive successful tests were conducted and new equipment developed.

In the years from 1944 to 1953, Madaras developed additional special equipment and continued demonstrating his process to the steel industry. In this period, he was aided by Dr. Arthur H. Compton, noted U. S. scientist, and had the assistance of syndicate financing. A license to use the process commercially was granted in 1953 to a Mexican firm.

The Arkota plant at Coolidge is the first to use the Madaras reduction process commercially in the United States. This plant makes use of more advanced equipment and process techniques invented and developed by Madaras since 1953.

Arkota Steel Corporation is the exclusive licensee for the Madaras process in Arizona, and also holds non-exclusive licenses for Washington, Oregon, California and Nevada.